SCIENCE

FRIDAY, AUGUST 18, 1911

CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

DOCTORATES CONFERRED BY AMERICAN UNIVERSITIES

THE universities of the United States have this year conferred the degree of doctor of philosophy[1] on 437 candidates, a considerable increase over the number in any preceding year. In the ten-year period from 1898 to 1907 the average number was 272.4, in the four last years the numbers have been 378, 389, 358 and 437. About 50 Americans receive annually the degree of doctor of philosophy or its equivalent abroad, and about three fourths of those who carry forward scientific research hold the degree. The writer has compiled data, not yet published, which show that about three fourths of those who receive the doctor's degree in science continue to do scientific work. From these figures it appears that about four hundred a year are added to those engaged in scientific and scholarly work. This is a small number compared with those who enter other professions, but it is at all events gratifying that it has about doubled since the publication of

[1] Including two doctorates of science, one at Harvard and one at New York, and two doctorates of engineering, one at the Massachusetts Institute and one at the Ohio State. The latter degree may be desirable, the former is not. When 239 degrees are given in the natural and exact sciences it is rather absurd to call 237 of them doctorates of philosophy and two doctorates of science. At Harvard the doctorate of philosophy does not mean that the candidate has studied Latin in the secondary school, but the doctorate of science means that he has not. In the interests of consistency the degree of master of science was established several years ago at Harvard, but it was soon abandoned. The doctorate of science should be permitted to follow it.

these statistics was begun fourteen years ago.

The 75 degrees from Columbia is the largest number hitherto conferred by any American institution and places this university first in the total number of doctorates given in the past fourteen years. Chicago follows closely, with 545 degrees, 10 fewer than Columbia, and is followed by Harvard, Yale, Johns Hopkins, Pennsylvania and Cornell, the decrease being in each case in the neighborhood of fifty degrees. These seven universities are responsible for about three fourths of the degrees conferred. Among state universities, Wisconsin and Illinois have maintained the position which they have recently acquired, having granted this year, respectively, 15 and 11 degrees, as compared with six from Michigan and the same number from California. During the ten-year period beginning in 1898, Chicago, Harvard, Columbia, Yale and Johns Hopkins conferred nearly the same number of degrees, varying from 356 at Chicago to 305 at the Johns Hopkins. In the course of the past four years Columbia has taken a decided lead, while Cornell and Pennsylvania have passed the Johns Hopkins and approach Yale. The figures are: Columbia, 233; Chicago, 189; Harvard, 157; Yale, 134; Cornell, 125; Pennsylvania, 116; Johns Hopkins, 106. The standards maintained by these universities are not the same. The percentages of the doctors who took their degrees prior to 1906 in the natural and exact sciences attaining the standard of scientific recognition indicated by the asterisks in the "Biographical Directory of American Men of Science" are: Harvard, 37; Johns Hopkins, 34; Chicago, 27; Cornell, 22; Columbia, 20; Yale, 19; Pennsylvania, 8. It should, however, be noted that the superior records of Harvard and the Johns Hopkins are in part due to the fact that they gave a relatively larger number of degrees at an earlier period.[2]

The number of doctorates conferred in the natural and exact sciences is increasing more rapidly than in other subjects. Prior to 1908 the average number of degrees conferred in the sciences was 124, as compared with 148 in the other group; in the three following years the average numbers were 186 and 189, respectively; this year the numbers were 239 and 198. As shown in Table II., Chicago is the university which has conferred the largest number of degrees in the natural and exact sciences, followed by the Johns Hopkins and Columbia. Of the degrees conferred at Cornell, 64 per cent. have been in the sciences, at the Johns Hopkins 58 per

[2] The report of the commissioner of education gives annually the number of doctorates of philosophy conferred by American universities, and as it is printed later than the report in SCIENCE it might be assumed to be more complete and accurate. This, however, appears not to be the case. In the report for 1910 St. Louis University is reported as giving 17 doctorates of philosophy and Grove City College 6. The degrees attributed to St. Louis University were an error, no doctorates of philosophy having been conferred. Grove City College may have had a legal right to confer this degree, but according to the same report of the commissioner of education it has no graduate students and its total endowment is $25,000. In answer to an inquiry the president of this college writes: "In reply to your esteemed favor would say, that the six doctorates to which you refer were conferred by Grove City College upon men who had previously received their bachelor degrees and who had given two years and more to the prescribed courses of study in philosophy maintained by this institution and in addition, two full summers in residence under my personal instruction, as well as that of Professor Ormond, of Princeton, and Professor John E. Clarke, of the Boston University. Some of these also had taken a course at Grove City under the late Borden P. Bowne, who assisted me in this work for some twelve or fourteen years. Any further information desired will be promptly forwarded."

TABLE I

Doctorates Conferred

	Average of 10 Yrs. 1898–1907	1908	1909	1910	1911	Total for 14 Yrs. 1898–1911
Columbia	32.2	55	59	44	75	555
Chicago	35.6	54	38	42	55	545
Harvard	33.8	42	38	35	42	495
Yale	31.8	32	44	27	31	452
Johns Hopkins	30.5	28	27	23	28	411
Pennsylvania	22.5	32	29	26	29	341
Cornell	18.1	22	34	35	34	306
Wisconsin	8.6	17	16	18	15	152
Clark	8.7	11	9	14	16	137
New York	6.7	15	13	11	17	123
Michigan	6.9	4	13	7	6	99
Boston	4.4	11	13	6	13	87
California	3.3	4	10	6	6	59
Princeton	2.6	6	4	8	9	53
George Washington	2.8	3	4	4	5	44
Virginia	2.8	4	1	4	2	39
Bryn Mawr	2.1	4	2	5	5	37
Illinois	.5	5	4	12	11	37
Minnesota	2.4	3	5	1	2	35
Brown	2.3	2	5	1	4	35
Catholic	2.0	1	3	3	5	32
Stanford	1.4	2	3	5	4	28
Nebraska	2.0	2	2	1	0	25
Iowa	1.1	2	0	4	3	20
Cincinnati	.3	0	2	2	5	12
Massachusetts Inst.	.3	3	0	3	2	11
Missouri	.4	3	0	2	2	11
Georgetown	1.0	0	0	0	0	10
Vanderbilt	.6	1	1	2	0	10
Washington	.7	1	0	0	2	10
Indiana	.0	3	3	0	2	8
Ohio	.4	0	2	0	2	8
Pittsburgh	.1	4	0	2	1	8
Kansas	.3	0	0	3	1	7
Syracuse	.2	0	2	1	2	7
Colorado	.5	0	1	0	0	6
North Carolina	.5	0	1	0	0	6
Northwestern	.4	0	1	0	1	6
Tufts	.5	0	0	1	0	6
Washington and Lee	.4	1	0	0	0	5
Lafayette	.3	0	0	0	0	3
Dartmouth	.1	1	0	0	0	2
Lehigh	.2	0	0	0	0	2
Tulane	.1	0	0	0	0	1
Total	272.4	378	389	358	437	4,286

TABLE II

Doctorates Conferred in the Sciences

	Average of 10 Years 1898–1907	1908	1909	1910	1911	Total for 14 Years 1898–1911	Per Cent.
Chicago	16.4	37	20	24	35	280	51
John Hopkins	16.8	17	20	15	19	239	58
Columbia	13.4	21	23	11	29	218	39
Harvard	14.1	13	14	10	20	198	40
Cornell	10.4	15	24	27	27	197	64
Yale	12.4	16	27	12	15	194	43
Pennsylvania	9.0	18	13	12	10	143	42
Clark	7.7	11	8	14	16	126	91
Wisconsin	2.8	6	4	13	13	64	42
California	2.4	2	6	4	5	41	70
Michigan	2.8	1	5	1	3	38	39
George Washington	1.7	2	2	3	4	28	64
Princeton	1.1	3	3	2	5	24	45
Brown	1.2	2	2	1	3	20	59
Illinois	.3	0	2	9	6	20	54
Stanford	1.1	2	2	1	4	20	71
Nebraska	1.3	1	2	1	0	17	68
Bryn Mawr	1.0	1	0	2	1	14	38
Virginia	1.1	2	0	1	1	15	39
Minnesota	.7	1	2	1	2	13	37
New York	.6	1	3	2	1	13	11
Massachusetts Inst.	.3	3	0	3	2	11	100
Iowa	.7	0	0	2	1	10	50
Washington	.7	1	0	0	2	10	100
Missouri	.3	2	0	2	2	9	82
Catholic	.5	—	2	0	1	8	25
Indiana	.0	3	3	0	2	8	100
Ohio	.4	0	2	0	2	8	100
Cincinnati	.1	0	1	1	4	7	58
Kansas	.3	0	0	3	1	7	100
Tufts	.5	0	0	0	0	5	83
Vanderbilt	.3	1	1	0	0	5	50
North Carolina	.3	0	1	0	0	4	67
Northwestern	.2	0	1	0	1	4	67
Washington and Lee	.3	1	0	0	0	4	80
Syracuse	.1	0	0	1	1	3	43
Boston	.1	0	1	0	0	2	2
Colorado	.2	0	0	0	0	2	33
Dartmouth	.1	1	0	0	0	2	100
Lehigh	.2	0	0	0	0	2	100
Pittsburgh	—	—	—	1	1	2	25
Georgetown	.1	0	0	0	0	1	10
Lafayette	.1	0	0	0	0	1	33
Total	124.1	184	194	179	239	2,037	48

cent., at Harvard 40 per cent., at Columbia 37 per cent. It is somewhat curious that the percentages at Wisconsin, Michigan, Illinois and Minnesota, should be as small as 42, 39, 54 and 37, respectively, as it is the general impression that the sciences are especially emphasized at the state universities.

There were this year 65 degrees in chemistry, a larger number than had previously been conferred in any subject. It should, however, be remembered that chemistry is pursued like medicine as a preparation for professional work, and that a large percentage of those who take the doctor's degree in this science do not publish research work. The 37 degrees conferred in physics was the largest number that has been

TABLE III

Doctorates Distributed According to Subjects

	Average 10 Years 1898–1907	1908	1909	1910	1911	Total for 14 Years 1898–1911
Chemistry	32.3	54	43	48	65	533
Physics	15.5	22	25	25	37	264
Zoology	15.2	25	18	24	25	244
Psychology	13.5	23	21	20	23	222
Mathematics	12.1	23	14	23	25	206
Botany	12.6	11	16	10	20	183
Geology	7.1	5	13	10	15	114
Physiology	4.1	7	13	4	2	67
Astronomy	3.4	1	7	3	4	49
Agriculture	1.0	2	7	4	11	34
Bacteriology	1.4	1	5	1	4	25
Anthropology	1.0	4	4	2	2	22
Paleontology	1.6	1	0	2	0	19
Anatomy	.9	2	0	1	1	13
Pathology	.5	2	3	1	1	12
Engineering	.8	0	0	1	2	11
Mineralogy	.6	0	3	0	1	10
Metallurgy	.3	0	1	0	0	4
Geography	.1	1	1	0	1	4
Meteorology	.1	0	0	0	0	1
Total	124.1	184	194	179	239	2,037

	1908	1909	1910	1911	Total for 4 Years
English	30	27	31	33	121
History	32	22	25	26	105
Philosophy	25	14	19	26	84
Economics	17	42	7	16	82
German	14	14	16	7	51
Education	6	9	13	23	51
Latin	12	12	15	11	50
Romance	12	16	6	12	46
Sociology	6	6	14	18	44
Oriental	9	15	11	1	36
Greek	13	11	5	7	36
Political Science	9	4	9	6	28
Theology	7	2	1	7	17
Philology and Comparative Literature	0	1	5	1	7
Law	1	0	1	2	4
Music	1	0	1	1	3
Classical Archeology	0	0	0	1	1
Total	194	195	179	198	766

conferred in any science except chemistry. In the total number of degrees conferred, chemistry and physics are followed by zoology, psychology, mathematics, botany and geology. There were 33 degrees conferred in English, 26 in history and in philosophy, and 23 in education. The degrees conferred in foreign languages appear to be few in comparison with the number of teachers required in these subjects —11 in Latin, 7 in Greek, 12 in Romance languages and 7 in German.

The institutions which this year conferred two or more degrees in a science are: in *chemistry,* Johns Hopkins, 11; Harvard, 9; Chicago and Yale, 8 each; Columbia, 6; Cornell, 5; Wisconsin, 4; Brown, 3; Clark and Illinois, 2 each; in *physics,* Chicago, 6; Columbia, 5; Pennsylvania, Stanford and Wisconsin, 3 each; Clark, Cornell, Harvard, Johns Hopkins and Princeton, 2 each; in *zoology,* Columbia, Cornell and Harvard, 4 each; Chicago, Cincinnati, Clark and Indiana, 2 each; in *psychology,* Clark, 7;[3] Chicago, 6; Columbia, 4; Pennsylvania, 3; in *mathematics,* Yale, 5; Chicago, 4; Clark, Johns Hopkins, Pennsylvania and Princeton, 2 each; in *botany,* Chicago and Cornell, 4 each; Columbia, 3; Harvard and Johns Hopkins, 2 each; in *geology,* Wisconsin, 4; Columbia, 3; Chicago, Cornell, Harvard and Johns Hopkins, 2 each; in *agriculture,* Cornell, 6; Missouri, 2.

The names of those on whom the degree was conferred in the natural and exact sciences, with the subjects of their theses, are as follows:

UNIVERSITY OF CHICAGO

Henry Foster Adams: "Some Problems of Autokinetic Sensations."

Charles Orval Appleman: "Some Observations on Catalase."

Richard Philip Baker: "The Problem of the Angle-bisectors."

Jasper Converse Barnes: "Experimental Analysis of Voluntary Movement."

George William Bartelmez: "The Bilaterality of the Pigeon's Egg; A Study in Egg Organization."

William Hunt Bates: "An Application of Sym-

[3] At Clark education appears to be included under psychology, and in some other cases the thesis in psychology is not based on experimental work.

bolic Methods to the Treatment of Mean Curvatures in Hyper-space.''

Louis Begeman: ''The Determination of 'e' by the Cloud Method.''

Edwin Sherwood Bishop: ''A Determination of the Minimum Ionizing Kinetic Energy of an Electron in a Gas.''

Daniel Buchanan: ''A Class of Periodic Solutions of the Problem of Three Bodies, Two of Equal Mass, the Third moving on a Straight Line.''

Emma Perry Carr: ''The Aliphatic Imidoesters.''

Ethel Mary Chamberlain: ''Purkinje Phenomenon.''

Elbert Edwin Chandler: ''Ionization Constants of the Second Hydrogen Ion of Dibasic Acids.''

Grace Miriam Charles: ''The Anatomy of the Sporeling of Marattia Alata.''

J. Harry Clo: ''The Effect of Temperature upon the Ionization of Gas.''

William Skinner Cooper: ''The Climax Forest of Isle Royale, Lake Superior.''

Ira Harris Derby: ''Studies in Catalysis of Imidoesters, IV.''

Mabel Ruth Fernald: ''A Contribution to the Technique of Diagnosis and Development of Mental Imagery.''

Harvey Fletcher: ''A Verification of the Theory of Brownian Movements and a Direct Determination of the Value of Ne for Gaseous Ionization.''

Thomas Bruce Freas: ''A Study of Thermostats.''

Thomas Haigh Glenn: ''Variation and Carbohydrate of Bacilli of the Proteus Group.''

Mary Holmes Stevens Hayes: ''Cutaneous After-sensations.''

Allen David Hole: ''The Pleistocene Geology of the Telluride (Colo.) Quadrangle.''

Ansel Alphonso Knowlton: ''Preparation and Testing of Heusler Alloys.''

Stewart Joseph Lloyd: ''Studies in Radioactivity.''

Paul Stilwell McKibben: ''The Nervous Terminalis in Urodele Amphibia.''

John Colin Moore: ''The Action of Water on Acyl Isoureas.''

William Cabler Moore: ''Studies in Organic Amalgams.''

Robert Kirkland Nabours: ''Mendelian Inheritance in Orthoptera.''

Arthur Dunn Pitcher: ''The Interrelations of Eight Fundamental Properties of Classes of Functions.''

John Littlefield Tilton: ''The Pleistocene Deposits of Warren County, Iowa.''

Fred Wilbert Upson: ''On the Action of Normal Barium Hydroxide on d. Glucose and d. Galactose.''

Clara Jean Weidensall: ''Studies in Rhythm.''

Marion Ballantyne White: ''The Dependence of the Focal Point on Curvature in Space Problems of the Calculus of Variations.''

James Remus Wright: ''Photo-electric Effects of Metals as a Function of the Wave-length of the Incident Light.''

Mary Sophie Young: ''Morphology of the Podocarpineæ.''

COLUMBIA UNIVERSITY

Le Roy Abrams: ''A Phyto-geographical and Taxonomic Study of the Southern California Trees and Shrubs.''

George Denton Beal: ''Stilbazoles and Schiff Bases in the 4-quinazolone Group.''

Ralph Curtiss Benedict: ''The Genera of the Fern Tribe Vittarieæ.''

Frederick Gordon Bonser: ''The Reasoning Ability of Children of the Fourth, Fifth and Sixth School Grades.''

Joseph Valentine Breitwieser: ''Attention and Movement in Reaction Time.''

Jessie Yereance Cann: ''The Relationship existing between the Weight of a Falling Drop and the Diameter of the Tip from which it Falls.''

Garabed Krikor Daghlian: ''The Drop Weights of Twenty Non-associated Liquids and the Molecular Weights calculated for them.''

Clarence Norman Fenner: ''The Watchung Basalt and the Paragenesis of the Zeolites and other Secondary Minerals.''

George Augustus Geiger: ''Researches in the Quinazoline Group.''

Clarence Everett Gordon: ''The Geology of the Poughkeepsie Quadrangle.''

Isidor Greenwald: ''The Effect of Parathyroidectomy upon Metabolism.''

Edmund Newton Harvey: ''Studies on the Permeability of Cells.''

Michael Heidelberger: ''Phthalones in the Quinazolone Series and their Derivatives.''

Frank Dunn Kern: ''A Biologic and Taxonomic Study of the Genus Gymnosporangium.''

Edwin Kirk: ''The Structure and Relationships of certain Eleutherozoic Pelmatazoa.''

Francis Church Lincoln: ''Certain Natural Associations of Gold.''

Almer McDuffie McAfee: ''The Drop Weight

of the Associated Liquids—Water, Ethyl Alcohol, Methyl Alcohol and Acetic Acid.''

Charles Virgin Morrill: ''The Chromosomes in the Oogenesis, Fertilization and Cleavage of Coreid Hemiptera.''

Paul Radin: ''The Ritual and Significance of the Winnebago Medicine-lodge.''

Harry Wilfred Reddick: ''Systems of Tautochrones in a General Field of Force.''

Gaillard Sherburne Rogers: ''Geology of the Cortlandt Series and its Emery Deposits.''

Frederick William Schwartz: ''The Weight of a Falling Drop and the Laws of Tate. The Drop Weights and Molecular Weights of some of the Lower Esters.''

Aaron Franklin Shull: ''Studies in the Life Cycle of *Hydatina senta*.''

Edward Kellogg Strong, Jr.: ''The Relative Merit of Advertisements: a Psychological and Statistical Study.''

Edgar George Thomssen: ''The Weight of a Falling Drop and the Laws of Tate. The Determinations of the Molecular Weights and Critical Temperatures of Liquids by Aid of Drop Weights with an Improved Apparatus.''

Chin Yu Wen: ''The Effect of Organic and Inorganic 'Addition Agents' upon the Electro-deposition of Copper from Electrolytes containing Arsenic.''

Mary Theodora Whitley: ''An Empirical Study of certain Tests for Individual Differences.''

Louis Elsberg Wise: ''Para-aminobenzonitrile and its Derivatives.''

Leon Elmer Woodman: ''A Study of the Multiple Reflections of Short Electric Waves between two or more Reflecting Surfaces.''

CORNELL UNIVERSITY

Arthur Augustus Allen: ''The Red-winged Black-bird; a Study in the Ecology of a Cattail Marsh.''

Alvin Casey Beal: ''A Study of the Genus *Lathyrus*.''

George John Bouyoucos: ''Transpiration of Wheat Seedlings as affected by Soils, by Solutions of different Densities, and by various Chemical Compounds.''

Paul Prentice Boyd: ''On the Perspective Jonquières Involutions associated with the (2, 1) Ternary Correspondence.''

Mortimer Jay Brown: ''Aluminum Anodes in Liquid Ammonia Solutions of Ammonium Trinitride.''

Harold Joel Conn: ''A Study of Seasonal Variation among the Bacteria in Two Soil Plats of Unequal Fertility.''

Oscar Diedrich von Engeln: ''Phenomena associated with Glacier Drainage and Wastage.''

Henry Ellsworth Ewing: ''The Origin and Significance of Parasitism in the Acarina.''

Hing Kwai Fung: ''An Ecological Study of the American Cotton Plant with Incidental Reference to its Possible Adaptability in China.''

Henry Phelps Gage: ''The Radiant Efficiency of Arc Lamps.''

Franklin Stewart Harris: ''Studies in Soil Moisture and Fertility.''

Jessie Luella King: ''The Pyramid Tract and other Descending Paths in the Spinal Cord of the Sheep, and the Localization of the Motor Area in the Sheep's Brain by the Histological Method.''

Lewis Knudson: ''The Relation of *Aspergillus niger* and *Penicillium* sp. to Tannic Acid Fermentation.''

Robert Matheson: ''The Structure and Metamorphosis of the Fore-intestine of *Corydalis cornutus* L.''

Edson Hoyt Nichols: ''Octochlorindigo and some Derivates of the Tetrachlorphthalic Acid and Tetrachloranthranilic Acid.''

Edith Marion Patch: ''Homologies of the Wing Veins of the Aphididæ, Psyllidæ, Aleurodidæ and Coccidæ.''

Elmer George Peterson: ''The Elimination of Tubercle Bacilli.''

David Shepherd Pratt: ''A Study of the Phenol Sulphonic Acid Method for the Determination of Nitrates in Water.''

John Lyon Rich: ''Studies in the Physiography of Semi-arid Regions.''

Elmer Seth Savage: ''A Study of Feeding Standards for Milk Production.''

Pearl Gertrude Sheldon: ''The Atlantic Slope Areas.''

Louisa Stone Stevenson: ''The Fluorescence of Anthracene.''

John Pogue Stewart: ''Factors Influencing Yield, Color, Size and Growth in Apples.''

John Armor Veazey: ''The Relation of Discharge Potential, Density of Kathode Ray Current and Intensity of Fluorescence in Crystals.''

Errett Wallace: ''The Scab Disease of the Apple.''

Arthur John Wilson: ''Influence of Phosphorus in Feeds on the Phosphorus Content of the Egg, and the Chemical Character of the Phosphorus Compounds.''

Frederick Adolph Wolf: ''The Life History and Development of some Fungi.''

HARVARD UNIVERSITY

Thomas Barbour: "A Contribution to the Zoogeography of the East Indian Islands."

Frederick Barry: (1) "The Molecular Refractions of Hydrochloric Acid and of Stannic and Stannous Chlorides"; (2) "The Heats of Combustion of Homologous Hydrocarbons."

Harold Eugene Bigelow: (1) "Some Derivatives of Bromtriioddinitrobenzol and Related Compounds"; (2) "The Heat of Solution of Barium."

Walter Ray Bloor: "The Carbohydrate Esters of the Higher Fatty Acids."

Paul Whittier Carleton: "Some Derivatives of certain Quinones and Aromatic Diketones."

Emory Leon Chaffee: "A New Method of Impact Excitation of Undamped Electric Oscillations and their Analysis by Means of Braun Tube Oscillations."

Fletcher Barker Coffin: "A Revision of the Atomic Weights of Cobalt and Arsenic."

Edward Carroll Day: "The Effect of Colored Lights on Pigment Migration in the Eye of the Crayfish."

Robert Fiske Griggs: "The Development and Cytology of Rhodochytrium."

Harvey Cornelius Hayes: "An Investigation of the Errors in Cooling Curves and Methods for avoiding these Errors; also a New Form of Crucible."

George Leslie Kelley: (1) "The Constitution and Reactions of certain Halogenated Orthobenzoquinopyrocatechin Hemiethers"; (2) "The Transition Temperature of Sodium Chromate."

Frederick Henry Lahee: "A Study of Metamorphism in the Carboniferous Formation of the Narragansett Basin."

Henry Laurens: "The Reactions of Amphibians to Monochromatic Lights of Equal Intensity."

Herbert Eugene Merwin: "Mineralogical and Petrographical Researches, with special Reference to the Stability Ranges of the Alkali Feldspars."

Emile Raymond Riegel: (1) "The Quantitative Determination of Antimony by the Gutzeit Method"; (2) "The Action of Sulphur Trioxide on Carbon Tetrachloride and Silicon Tetrachloride."

Clarence Livingston Speyers: "The Compressibilities and Surface Tensions of Water and Six Hydrocarbons."

Alban Stewart: "A Botanical Survey of the Galapagos Islands."

Thorbergur Thorvaldson: (1) "A Revision of the Atomic Weight of Iron"; (2) "Methods for the Adiabatic Determination of Heats of Solution of Metals in Acids."

Edward Gaige Titus: "Monograph of the Species of *Hypera* and *Phytonomus* in America."

Samuel Everett Urner: "Certain Singularities of Point-transformations in Space of Three Dimensions."

JOHNS HOPKINS UNIVERSITY

Paul Gough Agnew: "A Study of the Current Transformer, with particular reference to Iron Loss."

Thomas Bryce Ashcraft: "Quadratic Involutions on the Plane Rational Quartic."

Clara Latimer Bacon: "The Cartesian Oval and the Elliptic Functions."

John Lattimore Carpenter: "An Investigation of Manometers, of small Bore, for Use in the Measurement of Osmotic Pressure."

Gentry Cash: "A Study of the Osmotic Pressure of Cane Sugar Solutions at 30°, 35° and 40°."

Ernest Pohl Doetsch: "On the Rearrangement of the Tautomeric Salts of 1, 4-diphenyl-5-Thionurazole and 1, 4-diphenyl-5-Thiolurazole."

Julia Anna Gardner: "On certain Families of the Gastropoda from the Miocene and Pliocene of Virginia and North Carolina."

James Samuel Guy: "Conductivity and Viscosity in Glycerol and in Binary Mixtures of Glycerol with Ethyl Alcohol, with Methyl Alcohol and with Water."

Arthur Dunham Holmes: "A Study of the Semi-permeable Membranes of Zinc Ferrocyanide and of Copper Cobalticyanide."

Henry Hallock Hosford: "The Conductivities, Temperature Coefficients of Conductivity and Dissociation of certain Electrolytes from 0° to 35° and of certain other Electrolytes from 35° to 65°."

William Ralph Jones: "The Development of the Vascular Structure of *Dianthera Americana* L."

Nathaniel Edward Loomis: "A Study of the Hydrogen Electrode and of the Calomel Electrode."

Joseph Llewellyn McGhee: "A Study of Nickel Ferrocyanide as a Membrane in the Measurement of Osmotic Pressure."

Eli Kennerly Marshall, Jr.: "On the Reactions of Diazoalkyls with Urazoles and their Salts."

John Beaver Mertie, Jr.: "The Igneous Rocks of the Raton Mesa Region of New Mexico and Colorado."

Carroll Mason Sparrow: "On the Effect of the

Groove Form on the Distribution of Light by a Grating.''

Eugene Pinckney Wightman: ''A Study of the Conductivity and Dissociation of Organic Acids in Aqueous Solution between 0° and 35°.''

Lula Gaines Winston: ''The Conductivity, Temperature Coefficients of Conductivity and Dissociation of certain Electrolytes in Aqueous Solution, and Evidence for the Complexity of the Ion.''

Harlan Harvey York: ''The Origin and Development of the Embryo-sac and Embryo of *Dendrophthora opuntioides* (L.) Eich. and *D. gracile* Eich.

YALE UNIVERSITY

Harry Leslie Agard: ''The Extension of some Theorems in the Theory of Sets of Points to N-dimensional Space.''

Ida Barney: ''Line and Surface Integrals.''

Rowland Sherwood Bosworth: ''The Rates of Solution of certain Metals in Dissolved Iodine, and their Relation to the Diffusion Theory.''

Burton Howard Camp: ''The Convergence of Singular Integrals.''

Morris S. Fine: ''Experimental Studies on the Utilization of Vegetable Proteins in Man and Animals.''

John Lewis Jones: ''Number Concept.''

Carlton Howard Maryott: ''On the Nature of the Reaction between Chlorine and Benzene in the Electrolytic Cell.''

Claud Clair Perkins: ''Molecular Silver, and its Use in the Gravimetric Determination of Iodine.''

Edwin Jay Roberts: ''The Separation of Cerium Earths.''

William Cumming Rose: ''Studies in Intermediary Metabolism: Mucic Acid and Carbohydrate Metabolism; the Physiology of Creatine and Creatinine Elimination, their Relation to Carbohydrate Metabolism.''

James Cox Sanderson: ''The Probable Influence of the Soil on Local Atmospheric Radioactivity.''

Samuel Ray Scholes: ''A Study of Vapor Pressures.''

Louise Stanley: ''The Occurrence of Purine Enzymes in the Tissues of Invertebrates and Lower Vertebrates.''

Neil Everett Stevens: ''The Meiotic Phase in Heterostylous Plants.''

Wallace Alvin Wilson: ''Theory of Point-aggregates applied to Lebesque Integrals.''

UNIVERSITY OF WISCONSIN

William Henry Collins: ''The Geology of Gowganda Mining Division.''

Guy Henry Cox: ''The Origin of the Lead and Zinc Ores of the Upper Mississippi Valley.''

James Nimrod Currie: ''A Study of the Optical Form of Lactic Acid produced by Pure Cultures *B. Bulgaricus.*''

Paul Harrison Dike: ''Photo-electric Potentials of Thin Cathode Films.''

William Elmer Forsythe: ''A Determination of the Melting Point of Tungsten and Tantalum.''

Charles Baldwin Gates: ''The Replacement and Solution of Metals in Non-aqueous Liquids.''

Alcan Hirsch: ''The Preparation and Properties of Metallic Cerium.''

Arden Richard Johnson: ''A Study of Organic Boro-nitrogen Compounds.''

Charles Townsend Kirk: ''Conditions of Mineralization of the Copper Veins at Butte, Montana.''

Jesse Talbot Littleton, Jr.: ''The Optical Constants of Alloys as a Function of Composition.''

Frederick McAllister: ''The Cytology of Convallariaceæ.''

Leon Irwin Shaw: ''Studies of the Conductivity of Non-aqueous Solutions.''

Joseph Douglas Trueman: ''The Value of certain Criteria for the Determination of the Origin of Foliated Crystalline Rocks.''

CLARK UNIVERSITY

Charles Walter Bacon: ''A Study of Fractional Distillation.''

Guy Gaillaird Becknell: ''On Demagnetization of Iron and Steel Bars by Strain and Impact.''

Thomas Charles Carrigan: ''The Law and the American Child.''

Floyd Earle Chidester: ''Cyclopia in Mammals.''

Edmund Smith Conklin: ''Pedagogy of College Ethics.''

Herbert Carroll Cooley: ''The Religious Education of Children.''

Robert Hutchings Goddard: ''Current Rectification at Contacts of Dissimilar Solids.''

Louis Dunton Hartson: ''The Psychology of the Club: A Study in Social Psychology.''

McLeod Harvey: ''The Pedagogy of Missions.''

Solomon Lefschetz: ''On the Existence of Loci with Given Singularities.''

William Alderman Matheny: ''Biology of *Sclerotinia fructigena* and *Sclerotinia cinerea.*''

William John Montgomery: ''Singularities of Twisted Quintic Curves.''

Leonard Blaine Nice: ''The Comparative Effects of Alcohol, Nicotine and Caffeine on the Growth and Reproduction of White Mice.''

Simeon Spidle: "The Belief in Immortality."

Harry Porter Weld: "An Introspective Study of the Appreciation of Music."

Clarence Delette Wright: "A New Study of Steric Hindrance in Esterification."

UNIVERSITY OF PENNSYLVANIA

Norman Cameron: "A New Method for Determining Rate of Progress, Retardation and Elimination, as exemplified from the Records of a Small School System."

Melvin Reece Harkins: "The Transmission of Sound through Porous and Non-porous Materials."

William Brooks Hicks: "The Use of Sulphur Monochloride in the Decomposition and Analysis of Rare Earth Minerals."

John Ezra Hoyt: "Oscillographic Study of the Singing Arc."

Claude Stone McGinnis: "The Transmission of Sound through Porous and Non-porous Materials."

Norman Eugene McIdoo: "Lyriform Organs and Tactile Hairs of Araneads."

Walter Ross Marriott: "The Determination of the Order of the Groups of Isomorphisms of the Groups of Order P^4, where P is a Prime."

Louis O'Shaughnessy: "The Integrability of the Differential Equation representing the Sum of a Family of Series."

George Byron Armbruster Phillips: "Retardation in the Elementary Schools of Philadelphia."

Walter Jorgensen Young: "A Study in Practise and Habit; an Investigation into Motor Coordination, in its Relation to Attention, Association, Modification, Repetition and Habit."

UNIVERSITY OF ILLINOIS

Charles Eldrid Burke: "Molecular Rearrangements in the Camphor Series, Lauronolic Acid."

Walter Byron Gernert: "Unit Characters in Corn and their Behavior in Transmission."

George Roger LaRue: "The Genus *Proteocephalus*, Attention being given to the Morphology and Histogenesis of the Forms and to the Taxonomy of the Genus."

Duncan Arthur MacInnes: "The Physical Properties of Moderately Concentrated Aqueous Solutions of Electrolytes. (1) Salts of the Univalent Type."

William Warren Stifler: "The Magnetic Properties of Cobalt, with Especial Reference to their Interpretation on the Electron Theory and the Theory of Intrinsic Molecular Field."

Ellis Bagley Stouffer: "Invariants of Linear Differential Equations with Applications to Projective Differential Geometry."

UNIVERSITY OF CALIFORNIA

Annie Dale Biddle: "Constructive Theory of the Unicursal Plane Quartic by Synthetic Methods."

Hiram Wheeler Edwards: "The Resistance of certain Linear Conductors to Alternating Currents of High Frequency."

Joseph Eames Greaves: "Some Factors Influencing the Quantitative Determination of Gliadin."

John Alden Mason: "The Ethnology of the Salinan Indians."

Arthur Russell Moore: "On Mendelian Dominance."

PRINCETON UNIVERSITY

Robert Daniel Carmichael: "Linear Difference Equations and their Analytic Solutions."

Frederick Wahn Beal: "Associated Normal Congruences."

Otto Stuhlmann, Jr.: "The Difference in the Photoelectric Effect caused by Incident and Emergent Light."

Clinton Joseph Davisson: "Positive Thermions from Salts and Alkaline Earths."

Aute Richards: "The Method of Cell Division in the Development of the Female Sex Organs of *Moniezia*."

UNIVERSITY OF CINCINNATI

Annette Frances Braun: "Observations on the Development of Color in the Pupal Wings of Several Species of *Lithocolletis*."

Leon Denning Peaslee: "Studies on *Phagocata gracilis* (Leidy)."

Winfred Paul Webber: "On the Construction of Doubly Periodic Functions which have Singular Points (Polar and Essential) in the Period Parallelogram."

Everett Irving Yowell: "Orbit of Asteroid 1910 JR."

GEORGE WASHINGTON UNIVERSITY

George Nelson Coffey: "A Study of the Soils of the United States."

Hayner Haskell Gordon: "An Investigation of the Crystal Rectifying Delectors."

Grace Helen Kent: "Experiments on Habit Formation in Dementia Præcox."

Charles Neil McBryde: "A Bacteriological Study of Ham Souring."

LELAND STANFORD JUNIOR UNIVERSITY

Albert Edward Caswell: "Determination of Peltier Electromotive Force for several Metals by Compensation Methods."

Fred Finley Fitzgerald: "The Electrical Conductivity and Viscosity of Solutions in Methylamine and Ethylamine."

George Francis McEwen: "The Measurement of the Coefficient of Viscosity of Liquids by Means of the Forced Vibrations of a Sphere."

Perley Ason Ross: "Refractive Index of Metals."

BROWN UNIVERSITY

Moses Leverock Crossley: "Certain Derivatives of Anthraquinone of the Amido and Sulphonic Series."

Louis John Gillespie: "The Gas Metabolism of the Colon and Typhoid Bacilli."

George Barrows Obear: "The Hygrometric Properties of Gelatinous Media."

UNIVERSITY OF MICHIGAN

Floyd Earl Bartell: (1) "The Permeability of Porcelain and Copper Ferrocyanide Membranes; (2) "The Size of Pores in Porcelain and Osmotic Effects."

William Orville Mendenhall: "On the Characteristic Properties of Sum-formulæ in the Theory of Divergent Series."

Archie Garfield Worthing: "Some Thermodynamic Properties of Air and of Carbon Dioxide."

INDIANA UNIVERSITY

Max Mapes Ellis: "The Gymnotid Eels."

Will Scott: "The Fauna of a Solution Pond."

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Eugene Clarence Howe: "A Biometric Investigation of certain Non-spore-forming Intestinal Bacilli."

Reginald Lamont Jones: "The Effects of Heat and Magnetization on the Magnetic Properties of Iron."

UNIVERSITY OF MINNESOTA

Keivin Burns: "Photographic Study of the Region of the Great Nebula in Orion."

Louis Williams McKeehan: "The Terminal Velocity of Fall of Small Spheres in Air at Reduced Pressures."

UNIVERSITY OF MISSOURI

Leonard Dixon Haigh: "A Study of the Variations in Chemical Composition of the Timothy and Wheat Plants during Growth and Ripening."

Charles Robert Moulton: "A Study of the Chemical Composition of Cattle on Different Planes of Nutrition, and of the Relative Cost of Maintenance and Growth."

OHIO STATE UNIVERSITY

Lou Helen Morgan: "The Preparation and Oxidation of Styrolene Alcohol."

Cyrus Alan Melick: "An Investigation of the Stresses in Tall Steel Buildings of the Cage Construction Type with Portal Bracing."

WASHINGTON UNIVERSITY

John Jacob Kessler: "The Nitrite of Fumaric Acid."

Caroline Rumbold: "The Effect of the Acidity and Alkalinity of the Substratum on the Growth of Wood-destroying and Wood-staining Fungi, with a Discussion of the Systematic Relation of *Ceratostomella* and *Graphium*."

BRYN MAWR COLLEGE

Marie Gertrude Rand: "A Quantitative Examination of the Factors which Influence the Campimetrical Observation."

CATHOLIC UNIVERSITY OF AMERICA

Patrick Joseph Waters: "Studies in the Principle of Apperception."

UNIVERSITY OF IOWA

Charles McLean Fraser: "The Systematic Study of the Hydroids of the North Pacific Coasts of America."

UNIVERSITY OF KANSAS

Henry A. Kohman: "Salt-rising Bread."

NEW YORK UNIVERSITY

Erich Hausmann: "Electric Wave Propagation and Distortion along Conductors."

NORTHWESTERN UNIVERSITY

Eli Victor Smith: "Histology and Histogenesis of the Sensory Ganglia of Birds."

UNIVERSITY OF PITTSBURGH

Otto E. Jennings: "The Mosses of Western Pennsylvania."

SYRACUSE UNIVERSITY

Louis Lindsay: "The Minors of a Compound Determinant."

UNIVERSITY OF VIRGINIA

Charles Pollard Olivier: "175 Parabolic Orbits and other Results deduced from Observations of 6,200 Meteors."

FORECAST OF THE PORTSMOUTH MEETING OF THE BRITISH ASSOCIATION[1]

THIS year, for the first time in its history, the British Association for the Advancement of Science will meet at Portsmouth. There is no other town of similar size and importance in the United Kingdom which has not extended hospitality to the British Association during the fourscore years of its existence. Why Portsmouth should have remained unvisited until now it is difficult to say. The ancient centers of learning like Oxford and Cambridge and the great manufacturing centers of the midlands and the north naturally have had the principal claim on the attention of the British Parliament of Science in the course of its peripatetic career. But ports and resorts along the south coast besides Portsmouth were long ago visited by the British Association, and some have received a second visit. Plymouth was the scene of the association's annual meeting as far back as 1841, and again welcomed the association in 1877. Southampton was visited in 1846 and 1882, Brighton in 1872, and Dover in 1899.

With one exception, the experience of the British Association does not encourage hopes of a large gathering when the meeting-place is on the south coast. At the first Plymouth meeting in 1841, which began on July 20, under the presidency of the Rev. Professor W. Whewell, the attendance numbered only 891 persons; nor was the youthfulness of the association at that time the only explanation of the smallness of the number, for both at Glasgow in the previous year and at Manchester in the following year the attendance was 50 per cent. more. At the second Plymouth meeting, which opened in the middle of August, 1877, under the presidency of Professor A. Thomson, M.D., the attendance numbered 1,229 persons—considerably more than on the previous occasion, but less than half the attendance at Glasgow in 1876 and at Dublin in 1878. At the first Southampton meeting in 1846, which opened on September 10, under the presidency of Sir Roderick Murchison, the attendance was only 857, as compared with 1,079 at Cambridge in the previous year and 1,320 at Oxford in the following year. Again, at Southampton in 1882, when Dr. C. W. Siemens presided over a meeting which opened on August 23, the attendance numbered 1,253, and this meeting was sandwiched in between two of very much larger proportions, the attendance at York in 1881 being 2,557 and at Southport in 1883 being 2,714. At Dover, also, in 1899, when the association met in the middle of September, under the presidency of Sir Michael Foster, the attendance of 1,403 was very much less than the attendance at Bristol in the previous year (2,446) or at Bradford in the following year (1,915).

Brighton, however, furnishes an exception to the series of small meetings along the south coast, the strength of the meeting there in point of numbers being such that Portsmouth will do well if it attracts anything like the same attendance. The British Association met at Brighton on August 14, 1872, under the presidency of Dr. W. B. Carpenter, and the number of people registered as in attendance was returned as 2,533, a figure which compares favorably both with the attendance of 2,463 at Edinburgh in 1871 and with the attendance of 1,983 at Bradford in 1873. Of late years, quite apart from the particular place of meeting, the numbers taking part in the annual gatherings of the British Association have shown a tendency to decline. This is not surprising, seeing the way in which scientific meetings, congresses and publications, affording constant opportunity for making known the results of research work and for the discussion of those results, have multiplied. But the British Association still holds an important and unique position as the one body which affords an opportunity for intercourse and exchange of ideas between men who are interested in different branches of scientific investigation, and who in these days are more subject than ever they were to the dangers of too narrow a specialization. In providing a counteracting influence for this natural and inevitable tendency

[1] From the London *Times*.

of modern scientific inquiry, the British Association for the Advancement of Science may fulfil a function not less useful than any which it has served in the past. Those responsible for the conduct of the association's affairs have not been blind to the changing needs of the changing times, and although there is room for further modification in this direction, the efforts which have been made in the last few years, and are still being made to promote discussions among the different sections on subjects of broad and mutual interest, are deserving of all praise and encouragement. It would be a mistake to conclude from the somewhat disappointing attendances at recent British Association meetings that the association has outlived its usefulness. There is need for it to adapt its work to present-day conditions, and as and when this is done the long-hoped-for revival of interest in the annual meetings will naturally follow.

Apart from these fundamental considerations, the place and precise time of year fixed for each meeting unquestionably have much to do in determining the number participating in it, and consequently the sum of money at the disposal of the council for scientific grants. In this respect the Portsmouth meeting has much in its favor. It will open on Wednesday, August 30, and a careful analysis of the attendances at different meetings of the association held at different times of the year has shown that the meetings commencing in the last ten days of August have been among the most largely attended of any in the history of the association. Portsmouth itself has many and varied attractions, both for those who regard the week of the association's meetings as a time for the serious examination of an interesting field of study, and for those who look upon the week rather as a time of pleasant holiday, combining country excursions with brilliant social functions and the occasional hearing of instructive lectures delivered by the most eminent scientific men of the day. The history of the town extends back to the middle ages, and reveals constant and growing recognition of the advantages conferred on it by its situation, viewed from naval and strategical points of view. Ever since 1295 it has returned two members to parliament, and to-day the population of the county borough considerably exceeds 200,000. Portsmouth includes within its borders not only a great naval station and arsenal, but a popular watering-place, Southsea; and it is, as everybody knows, within easy reach both of the Isle of Wight and of the New Forest, districts which offer excellent opportunities as well for holiday jaunts as for the pursuit of field studies. The town itself is admirably equipped with educational institutions, in which the members of Section L will find much to interest them, while the dockyard presents an object-lesson in the application of modern engineering science to naval needs which will be appreciated by many besides the members of Section G. The arrangements for the meeting afford a guarantee that visitors will be able to see Portsmouth to the best advantage. Subject, of course, to the limitations imposed by the necessity of safeguarding national interests, special facilities will be afforded to the members of the British Association to view the dockyard, battleships and submarines and other government establishments.

The meeting will assemble, as usual, under the patronage of the king, Canon T. G. Bonney will be succeeded as president on the opening day by Sir William Ramsay and a very representative body of vice-presidents, including the Princess Henry of Battenberg, Alderman T. Scott Foster, the mayor of Portsmouth, Lord Winchester, Lord Lieutenant of the County of Hants, the Archbishops of Canterbury and York, and the Bishop of Winchester; Admiral Sir Arthur William Moore, the Commander-in-Chief at Portsmouth; Rear Admiral H. G. Tate, the Admiral Superintendent of the Portsmouth dockyard; Field-Marshall Earl Roberts, and Major-General J. K. Trotter, the General Officer Commanding Southern Coast Defenses. As in former years, there will be two evening discourses in addition to the presidential address. On Friday, September 1,

Dr. Leonard Hill will lecture on "The Physiology of Submarine Work," and on Monday, September 4, Professor A. C. Seward will lecture on "Links with the Past in the Plant World." The Saturday evening lecture to the operative classes will be delivered by Dr. Hugh Robert Mill. An attractive series of social functions is being arranged, including a garden party and reception, and an evening fête by the mayor of Portsmouth, and on Saturday, September 2, there will be excursions to the Isle of Wight, the New Forest, Chichester, Petworth and Arundel. On the Sunday there will be a special service at St. Mary's church, at which the Bishop of Winchester will preach.

In his presidential address Sir William Ramsay will sound as his leading note the increasing need of scientific training with a view to future as well as to present-day requirements. He will pass under review modern conceptions of the nature and constitution of the elements, especially radium and its products, and will proceed to consider the available sources of energy in this country and whether a reasonably economical use is being made of them. Having come to the conclusion that the present-day methods are wasteful, seriously limiting the period of our national existence, he will advocate an immediate stock-taking of our possessions of potential energy as the first step towards their judicious conservation.

For the following particulars of the sectional proceedings we are indebted to the courtesy of the sectional presidents and recorders.

Section A (Mathematical and Physical Science) will be presided over by Professor H. H. Turner, who proposes to consider in his opening address some of the lessons taught by the observational sciences (astronomy, meteorology, magnetism, seismology) as regards methods of work. He will emphasize the need for better organization, and will enforce his remarks by recalling recent cases which illustrate the need. A joint meeting between Section A and Section G (Engineering) has been arranged for a discussion on mechanical flight, which will be opened by Mr. A. E. Berriman, the technical editor of *Flight*. In the course of the week there will also be discussions on Stellar Distributions and Movements (to be opened by Mr. A. S. Eddington), and the Principle of Relativity (to be opened by Mr. E. Cunningham). Among the papers to be presented to the section will be one by Professor F. R. Watson, of Illinois, on the "Effect of Air Currents on Sound Waves"; Professor Pettersson will present a paper on "Great Boundary Waves," and will consider the parallactic tide set up in the bottom layers of the sea by the moon; Major E. H. Hills will have something to say on the "Infra-Red Spectrum," and Professor F. T. Tronton on the "Peculiarities in the Absorption of Salts by Silica."

Section B (Chemistry) will meet under the presidency of Professor J. Walker. The close relation between chemistry and agricultural science will be recognized in a joint meeting between Section B and Sub-section K, at which Dr. E. Frankland Armstrong will open a discussion on the part played by Enzymes in the Economy of Plants and Animals. At this meeting Mr. A. E. Humphreys will discuss the treatment of wheaten flour. Two other discussions will engage the attention of the chemists while at Portsmouth. In a discussion on Colloids, Professor Freundlich will deal with the "Theory of Colloids," Dr. G. Barger and Dr. E. Wechster with the "Absorption of Bromine by Graphite," and Dr. C. Desch with the "Colloid Theory of Cements." In another discussion on Indicators and Color, Dr. V. H. Veley will contribute a paper on the application of "Methyl Orange for the Determination of the Affinity Constants of Weak Acids and Bases," with a discussion on the Errors; Mr. H. T. Tizard will consider the "Use of Indicators in Modern Physico-Chemical Research"; Mr. J. E. Purvis, the "Absorption Spectra of Vapors"; and Dr. T. M. Lowry, the "Origin of General and of Specific Absorption." Professor G. Barus will submit to the section a paper on the "Diffusion of Gases through Water"; Professors W. H.

Perkins and W. J. Pope a paper on "Optically Active Systems containing no Asymmetric Atom," and Dr. W. Lewis a paper on the "Compressibility of Mercury." There will also be presented reports on "Electric Steel Furnaces," by Professor McWilliam, and "Solubility" by Dr. J. B. Eyre, as well as the reports of the research committees.

The president of Section C (Geology), Mr. A. Harker, proposes to deal in his presidential address with some aspects of the distribution of igneous rocks in "petrographical provinces" and the relations of these to the larger structure features of the globe. It is hoped to arrange for joint meetings with the Geographical Section, both for the consideration of the former connection between the South Coast of England and the Isle of Wight and for the consideration jointly with the Botanical Section of the plant life of the British Isles in relation to the glacial epoch.

In his presidential address to Section D (Zoology), Professor D'Arcy W. Thompson will deal with some of the new developments and problems of biology that have come into prominence during the past quarter of a century.

The debt which geography owes to the army and navy has been illustrated at several of the British Association meetings in recent years by the presence of a military or naval officer at the head of Section E. This year the geographers will meet under the presidency of Colonel C. F. Close, R.E. In the first part of his address he will discuss the purpose and position of geography, with special reference to its relations to other subjects. In order to ascertain the content of the subject, the last five years' work of the Royal Geographical Society will be examined and analyzed. The general effect of the work of geographical societies, schools and congresses will be indicated and an attempt made to determine the actual position of geography in the world of science. In the latter part of his address Major Close will give an account of the various ways in which the government departments have assisted the cause of geography, notably in the matter of mapping the empire. He will indicate the very large amount of this work which is being carried out all over the world, and will briefly describe some of the most important surveys. As regards the work of the section generally, an attempt has been made to arrange mainly for the discussion of a few subjects illustrating the advancement of geographical science, rather than for a multitude of separate papers. The way in which geography enters into every sphere of expanding activity will be demonstrated in a discussion on The Airman's Requirements, which it is hoped will be opened by Captain Bertram Dickson. Others expected to take part in this discussion are Captain Broke-Smith, of the Army Air Battalion; Mr. Eric H. Clift, Captain H. F. Wood, Captain Archibald R. Low, and Captain F. A. Sykes. A number of papers will relate to the sea. Mr. A. R. Hinks has promised a paper on the "Shape of the Sea Surface"; M. Ed. Henrici another on "Mean Sea Level"; Professor C. Pettersson will report the results of some "Recent Experiments on the Tidal Movements of the Deep Water of the Kattegat," and Dr. Gustav Ekman will describe some "Experiments with Automatic Current Measurements in the Open Sea." There will be a joint meeting with the geologists and botanists for the consideration of the relation of the present plant population of the British Isles to the Glacial Period, and probably another joint meeting with the geologists to discuss the former connection of the Isle of Wight with the mainland. Among various other contributions will be a lecture by Captain C. G. Rawling, of the British expedition to Dutch New Guinea, and a paper on "Mapping of Thermal Regions" by Professor A. J. Herbertson.

Section F (Economic Science and Statistics) will have as its president the Hon. W. Pember Reeves, formerly High Commissioner for New Zealand, and now Director of the London School of Economics. His opening address will deal with the subject of land taxation. In the later proceedings of the section, a discussion on land value taxes will be

opened by Mr. C. F. Bickerdike. Another discussion on Irish Finance will be opened by Professor C. H. Oldham. There will also be papers on "Variation of Wages," by M. Waxweiler, the Director of the Institut Solvay, Brussels; on "Destitution," by Mr. C. J. Hamilton; "Prison Reform," by Miss C. Smith Ronic; "The Merchant Service," by Mr. W. J. Hinton; "English Beet Sugar Industry," by Mr. Sigmund Stein, and the "State of Economic Science," by Mr. E. S. Grogan.

Section G (Engineering), which will meet under the presidency of Professor J. H. Biles, will have under consideration a number of subjects of great interest and importance. Besides the joint discussion with Section A on Aeronautics, to which reference has already been made, there will be a discussion on the respective merits of Super-Heated Steam Engines, Suction Gas Plants and Diesel Engines. Papers on these subjects will be contributed by Captain H. Riall Sankey, Mr. Tookey and Mr. Charles Day. It is hoped that Professor T. W. Howe will be able to show some interesting experiments on wireless telegraphy, and that Captain Sankey will be able to exhibit a portable wireless telegraphy equipment. Several papers relating to ships will be presented, dealing with recent improvements such as the Gyro-Compass (Mr. G. K. B. Elphinstone), Electrical Steering (Mr. B. P. Haigh), Electrical Drives for Ships' Propellers (Mr. H. A. Moor), and Marine Engines adapted for Burning Crude Oil (Mr. J. H. Rosenthal). Other papers will deal with the problem of Smoke Abatement (Dr. J. S. Owens), the Origin and Production of Corruption on Tramway Rails (Mr. Worby Beaumont), and the Vibragraph (Mr. Digby).

The president of Section H (Anthropology) will be Dr. W. H. R. Rivers, who will devote his address to a "Consideration of Ethnological Analysis of Culture." He will direct attention to the complexity of cultures often supposed to be simple and primitive, and will urge that the analysis of this complexity is a necessary preliminary to the study of the origin and development of institutions. The principles on which the analysis should be based will also be considered. As usual, a large number of papers on separate topics will be presented to the section, but a general discussion on the subject of totemism has been arranged. To this discussion papers will be contributed by Dr. A. C. Haddon, Dr. Kohler, Professor Graebner, M. A. van Geneep, Professor Hutton Webster, Dr. Goldweiser and Mr. Andrew Lang; it is hoped that Dr. C. G. Seligmann, Professor Fraser, Mr. R. R. Marett, M. Waxweiler, Mr. E. Thurston and Mr. E. S. Hartland will also take part in the discussion. The Roman portraits recently discovered in Egypt will be described by Professor H. M. Flinders Petrie, and some "Paintings in the Temple of the Tiger at Chichen Itza," by Miss A. C. Breton. The archeology of Peru will be discussed in a paper by Dr. Max Uhle. Major A. J. N. Tremearne has promised some "Notes on Hausa Folklore," and M. Malinowski a paper on the "Nature of the Australian Family." Ancient Britain will provide subjects for a number of papers, Mr. A. L. Lewis dealing with "Dolmens and Cromlechs," Mr. R. R. Marett with the "Recent Discovery of Pleistocene Man in Jersey," and Mr. W. Dale with "Prehistoric Man in Hampshire." "Paleolithic Man" will furnish the subject of a paper by Dr. A. Keith. Dr. F. C. Shrubsall will discuss the "Anthropology of Wessex," and "Some Unpublished Measurements of the Inhabitants of Dorset" will be presented by Mr. J. Gray.

Professor J. S. Macdonald, of Sheffield University, will preside over the deliberations of the physiologists (Section I). This section is one of those which usually receive a number of highly specialized papers capable of full appreciation only by the select few. This year, in addition to such contributions there will be three discussions of a wider range of interest, one on Sight Tests for Seamen, to be opened by Dr. C. F. Myers, followed by Dr. F. W. Edridge-Green; another on Ventilation in Confined Quarters, especially in Relation to Ships, to be opened

by Dr. Leonard Hill, followed by Professor N. Zunz, of Berlin; and a third on Inhibition, to be opened by Professor C. S. Sherrington, followed by Mr. Keith Lucas and Professor Macdonald. A report on Anesthetics will be followed by a paper on "Additions to the Use of a Chloroform Inhaler," by Professor A. C. Vernon Harcourt. Among a large number of other papers mention may be made of contributions by Professor Macdonald and Dr. J. E. Chapman on "Heat Production and Body Temperature during Rest and Work"; Dr. F. W. Edridge-Green, "Frequency of Color Blindness in Males"; Dr. Harriette Chick and Dr. C. J. Martin, of the Lister Institute, on the "Chemistry of Heat Coagulation of Proteins"; Dr. H. E. Roaf, "Some Considerations on the Influence of Hæmoglobin in the Hæmolysis of Red Blood Corpuscles"; Professor H. J. Hamburger, of Gröningen, "New Researches on Phagocytosis"; Dr. W. N. F. Woodland, on "Recent Views concerning the Physiology of Gas Production in connection with the Gas Bladder of Bony Fishes," and Dr. John Tait, various papers relating to the frog. An interesting exhibit, by Professor C. S. Sherrington, will be a model to illustrate Listing's law of the movements for the eyeball.

Professor F. E. Weiss will preside over Section K (Botany). A joint meeting has been arranged between this section and the Geological and Geographical Sections to consider the relation of the Present Plant Population of the British Isles to the Glacial Period. A general discussion on the subject will be opened by Mr. Clement Reid. Another discussion on the Principles of Construction of Phytogeographical Maps will probably be opened by Mr. A. G. Tansley. Additional interest will be lent to the proceedings of the section, and to these discussions in particular by the presence of a number of the most eminent continental and American plant geographers, who will be in England during August for an "International Phytogeographical Excursion to the British Isles." As the neighborhood of Portsmouth offers many attractions from the point of view of plant geography, excursions will play an important part in the program of the section. There will again be included in the "indoors" program a semi-popular lecture, which this year will be delivered by Mr. Francis Darwin. Other contributions to the sectional proceedings will include papers on "Phytogeography as an Experimental Science," by Professor Massart; "The Swiss National Park and its Flora," by Professor C. Schröter; "Some Petrified Jurassic Plants from Scotland," by Professor A. C. Seward; "Recent Work on Jurassic Plants of Yorkshire," by Mr. H. H. Thomas; "A Fifteen-Year Study of Advancing Sand Dunes," by Professor H. C. Cowles, of Chicago; "New Proposals in Ecology," by Professor F. E. Clements, of Minnesota; "The Vegetation of Pebble Beaches," by Professor J. W. Oliver; "The Seaweeds of a Salt Marsh," by Miss S. M. Baker; "The Water-content of Acidic Plants and the Wilting of Moorland Plants," by Mr. W. B. Crump; "The Morphology of Leguminous Nodules," by Professor Bottomley; "Nuclear Osmosis as a Factor in Mitosis," by Mr. A. A. Lawson; "Nuclear Division in *Spongospora*," and "The Polyphyletic Origin of the Cornaceæ," by Mr. A. S. Horne, and "The Transference of Sugar from the Host Plant to the Parasitic *Cuscuta*."

The Agricultural Sub-section is now attached to Section K. Its chairman, Mr. W. Bateson, proposes to devote his address to a consideration of the proper scope of an applied science, with special reference to the application of genetic research to agriculture and horticulture. The program of the subsection promises a series of most interesting and useful discussions and papers. Reference has already been made to the joint discussion arranged with the Chemical Section. Another discussion on How best the University Agricultural Department may come into Contact with the Farmer will be opened by Principal Ainsworth Davis, who will be followed by Mr. R. Hart-Synnot, dealing with the American and Canadian systems, and Mr. J. H.

Burton dealing with the place of the agricultural instructor. A third discussion on Bacterial Diseases in Plants will be opened by Professor M. C. Potter and further contributions to the consideration of the question have been promised by Mr. H. Priestley (Bacterial Diseases of Swedes and Celery), Mr. F. T. Brooks (Bacterial Gum Diseases), Dr. G. H. Pethybridge (Bacterial Disease of the Potato Plant in Ireland), Mr. G. T. Malthouse (Experiments on the Wart Disease of Potatoes), and Mr. A. Horn (Potato Disease). A popular lecture by Mr. A. D. Hall will discuss the soils and farming of the South Downs. Papers will also be contributed by Professor A. T. Wood, on "The Inheritance of Strength in Wheat"; Mr. B. T. P. Parker and Mr. V. F. Hillier, on "Cider Sickness"; Mr. S. U. Pickering, on "The Effects of Grass on Apple Trees"; Mr. J. H. Priestley and Mr. R. C. Knight, on "The Effect of High Tension Electric Discharges and Current Electricity on Plant Respiration"; Mr. C. C. Hurst, on "The Application of Genetics to Horse-breeding"; Mr. J. Wilson, on "The Inheritance of Milk Yield in Cattle"; Mr. J. Hindrick, on "The Effects of Ventilation on the Temperature and Carbon Dioxide of the Air of Byres"; Mr. J. Porter, on "Suggestions Relating to the Existing System of Imperial Avoirdupois Weights."

Bishop Welldon will preside over Section L (Educational Science), and proposes to take in his presidential address a general review of the existing educational system in Great Britain, particularly in England, with a view of suggesting some reforms in education, elementary, secondary and academical. He has been directly associated at different times with each of these three branches of education, as a fellow and tutor of his college, as headmaster of two public schools, and as a member of an education committee since he went to Manchester. His views will, therefore, be comprehensive in character, though necessarily he will be able to indicate only a few of the reforms which might be considered desirable in our educational system.

AUTOMATIC INCREASES IN SALARIES AT THE UNIVERSITY OF CALIFORNIA

THE regents on May 9 confirmed the following recommendation of the Finance Committee:

That it be of record that with the adoption of the budget for 1909–10, the regents inaugurated a system of automatic increases in salaries, whereby an instructor's salary is increased automatically $100 per year from $1,000 to $1,500, and the salaries of assistant professors $100 a year from $1,600 up to $2,000; and that the automatic increases do not apply to members of the faculty below the rank of instructor, nor above the rank of assistant professor, and that there is no automatic increase after instructors have arrived at a salary of $1,500, and after assistant professors have arrived at a salary of $2,000; further, that increases are not automatic in salaries of members of the faculty who are on part time only, as, for instance, certain members of the departments of architecture and law, nor in the case of the affiliated colleges, the department of agriculture, the Wilmerding School, etc.; nor in the case of instructors and assistant professors for a year of absence on leave, the two-thirds salary while on leave being based normally on the salary of the previous year, unincreased; and, further, that increases may, of course, be given in the cases cited above, in which no automatic increase is due as of right. Larger increases than of $100 are of course sometimes made at the discretion of the president, with the approval of the regents.

SCIENTIFIC NOTES AND NEWS

THE Paris Academy of Sciences has awarded its Lalande Prize to Dr. Lewis Boss. Its general prizes, each of the value of $2,000, have been awarded to M. Jules Tannery, of Paris, for his mathematical publications, and to M. Déperet, of Lyons, for his geological publications.

THE Paris Academy has elected corresponding members as follows: Professor Levi-Civita, of the University of Padua, in the section of mechanics; Dr. Paul Wagner, director

of the Agricultural Station at Darmstadt, in the section of agriculture; Dr. Sven Hedin, of Stockholm, in the section of geography, and Professor Julius Bernstein, of Halle, in the section of physiology.

Dr. Ernst Ehlers, professor of zoology at Göttingen, has celebrated the fiftieth anniversary of his doctorate.

Mr. C. V. Gregory, bulletin editor and head of the agricultural journalism department at the Iowa College and Station, has resigned to become editor of the *Prairie Farmer* of Chicago.

Mr. H. H. Harrington, director of the Texas Agricultural Station, has resigned to become agricultural director of the St. Louis, Brownsville and Mexico Railroad.

Dr. Richard Möhlau, professor of the chemistry of dye-stuffs in the Technical Institute at Dresden, has retired from active service.

Professor H. C. Wilson, director of Goodsell Observatory of Carleton College and editor of *Popular Astronomy,* has returned after a sabbatical year spent at the Lick Observatory. The assistant editors of *Popular Astronomy* are both absent for the coming year, Dr. Ralph E. Wilson entering upon a two-year appointment at the Lick Observatory and Mr. Curvin H. Gingrich spending the year in study at the Yerkes Observatory.

Before an enthusiastic audience at the University of California Sir John Murray gave, on May 11, an account of his researches in the life of the deep sea and of his explorations of the structure and composition of the bottom deposits of the Pacific and Atlantic oceans. The lecture was illustrated by views of the deep-sea fishes discovered by the lecturer in his recent cruise on the Atlantic in the Norwegian fishery research steamer, *Michael Sars.*

The monument to Avogadro, erected to commemorate the centenary of the law which bears his name, will be unveiled at Turin on September 24.

Baron Arthur de Saint-Joseph, the entomologist who recently died, has bequeathed his collections and his library to the Paris Museum of Natural History.

Dr. Johann Paul Schweitzer, professor of chemistry in the University of Missouri from 1872 until 1910, when he became professor emeritus, has died at Columbia. He was born in Berlin in 1840 and came to the United States in 1865. He was known for his work in analytic and agricultural chemistry.

Professor E. Grawitz, director of the department of internal medicine in the municipal hospital at Charlottenburg, known for his work on diseases of the blood, died in that city on July 11, aged fifty-one years.

The U. S. Civil Service Commission announces that the government desires to secure a ceramic chemist who will be able to take charge of the ceramic section of the structural material work of the Pittsburgh laboratory of the Bureau of Standards, salary $3,000 to $4,000 per annum, depending upon the experience of the man available. The duties of the position will include the direction of the work of investigation and testing of clay and clay products. The qualifications of the persons under consideration will be passed upon by an impartial board of scientific men. Only persons of established reputation as ceramic chemists will be given consideration for this vacancy. As the selection for this position will be made about September 1, qualified persons who desire to be considered are invited to submit their names to the U. S. Civil Service Commission at Washington, D. C., before this date.

To counteract effects of exaggerated reports about the small earthquake in San Francisco on July 1, the newspaper publishers of that city have announced the results of a careful inquiry. Concurring in the findings are Hiram Johnson, governor of California, and other state and city officers, as well as the observatory chief at the University of California and the acting director of the Lick Observatory. "Absolutely no damage," the publishers' statement says, "was done by the shock in question to persons or property in San Francisco. . . . The only place in the state which

suffered in any degree from the quake was the Lick Observatory, conducted by the University of California on Mount Hamilton, Santa Clara County, seventy-five miles from San Francisco and twenty-five miles from San José. Even there the damage was nominal, except to buildings injured by the earthquake of 1906 and not adequately repaired.

ARRANGEMENTS have been made by the trustees of Stanford University for the construction of the new Lane Library which is to be erected on the corner of Sacramento and Webster Streets, San Francisco, at a cost of $100,000. Excavation for the foundation has already been started and it is expected that the building will be ready for occupancy at the end of the school year. This building will house the Lane Medical Library which was founded by Dr. Lane, former president of Cooper Medical College, and the library of the Stanford medical department. The Lane Library was endowed by Dr. Lane and contains about 37,000 volumes, making it the largest library in the United States in direct association with a medical school.

THE *Geographical Journal* says that among the Austrian workers in the direction of an improved scheme for the coloring of relief-maps, based on the optic properties of colors, Herr G. Freytag, of the Cartographical Institute of Freytag and Berndt, at Vienna, deserves credit for the results attained. Like Dr. Peucker he has been working at the question for some years, and has arrived independently at a solution, which is briefly described in a pamphlet issued by his firm this year. It is accompanied by a specimen relief-map colored according to the scheme adopted, the effect of which is perhaps as satisfactory as any of the attempts hitherto made in the same direction. The stereoscopic effect of the colors selected is well brought out by a pair of diagrams, in the first of which a square is colored with the reds in the center, these passing outwards through yellow to green and blue; in the other the order is reversed. The former gives the appearance of being raised, the latter of being depressed, in the center. The gradations are brought about by the differences in the tints, the strength remaining the same, so that violent contrasts are avoided.

IN accordance with the resolutions passed on June 14 that the collections of the Geological Society should be divided between the British Museum and Jermyn Street, it is announced that the foreign series has already been removed to its new home at the British Museum (Nat. Hist.), is all in order in new cabinets, and can be referred to by responsible students.

THE *Geological Magazine* remarks that the extraordinary richness of the collections of the British Museum has rarely been better illustrated than by the table-case of German Cainozoic Mollusca just arranged and exhibited in the geological department by Mr. R. B. Newton with the assistance of Mr. G. K. Gude. The accumulation of nearly a hundred years, there is a fine series of the land, freshwater and lacustrine shells which lived in Germany from Oligocene to Post-Pliocene times exhibited for the first time. No such series is to be found in any continental museum. Many of the specimens came from localities now closed or inaccessible, and such well-known places as Cannstadt, Heinheim, Oeningen, Mosbach, Budenheim, Floersheim, Mainz, Wangen, Weimar, Taubach, Hochheim, Wiesbaden, and a score of others are represented in the collection. Similar series of Mollusca from the other continental areas are in course of arrangement, the French and Austro-Hungarian being already in hand.

THE electrical engineering department of the Massachusetts Institute of Technology received an appropriation of $3,000 from the Edison Electric Illuminating Company of Boston to be used in an investigation of the relative operating reliability and costs of electric trucks, gasoline trucks and horse trucking, for the purpose of determining to what degree electric trucks are adapted to compete with gas and horse trucks in the city of Boston. This investigation will cover the cost

of delivery of goods in the different ways. It will include all questions which concern electric trucks, including the influence of the different kinds of city pavements on cost of delivering goods, and the effects of different routings of the vehicles. The investigation will be partly theoretical, but it will be planned to determine practically what it ordinarily costs to deliver goods under city conditions. This part of the investigation will be accompanied by actual observations extended over a period of many months. At least a year will be occupied in this work, and Mr. H. F. Thomson has been appointed research associate to carry on the work under the direction of Professor Pender.

UNIVERSITY AND EDUCATIONAL NEWS

The physical laboratory at Göttingen has received gifts of $125,000 from Herr Krupp von Bohlen-Halbach and $40,000 from Herr von Boettinger.

We learn from the *Experiment Station Record* that the legislature has renewed for another period of five years the mill tax for the erection of buildings for the Iowa College and Station. It is estimated that over $1,000,000 will be available for this purpose durin the next six years. A library to cost $225,000 and a stock-judging pavilion to cost $20,000 are among the buildings definitely authorized. Special appropriations were also made of $60,000 for equipment of the domestic technology building, gymnasium and veterinary hospital, $6,000 for improvement of the grounds, $43,000 for the heating plant, $50,000 for general instruction, $18,000 for extension work, $15,000 for the station and $5,000 each for the engineering experiment station, the roads work and the two-year course.

The state board of education of Utah has provided that every accredited high school in the state must teach agriculture in order to participate in the maintenance fund provided for high schools.

The University of Athens will celebrate its seventy-fifth anniversary on March 25, 1912, at which time the International Congress of Orientalists will meet in the city.

The Consul General of Buenos Aires reports that a school of aviculture is to be established at La Plata as an annex to the zoological garden, to give instruction in poultry and bee keeping and in the rearing of rabbits and pigeons, the latter for consumption and as carriers.

The committee appointed recently by the board of regents of the University of Michigan to consider and report upon the organization of the Graduate School has been constituted as follows: President Hutchins, Regents Sawyer, Beal and Hubbard, Professor John O. Reed, dean of the faculty of literature, science and the arts; Dr. Victor C. Vaughan, dean of the faculty of medicine; Professor Fred N. Scott, chairman of the administrative council of the graduate school (at present a committee of the faculty of literature, science and the arts); Professor Alexander Ziwet, president of the Research Club; Professor R. M. Wenley, head of the department of philosophy. The committee will not convene till October.

The following appointments have been made in the medical department of Leland Stanford Junior University: Dr. Thos. Addis, Carnegie research scholar and fellow of the Royal College of Physicians of Edinburgh, to the position of assistant professor of medicine to have charge of the work in clinical chemistry; Dr. Jas. Eaves, of Edinburgh and of Guy's Hospital, London, instructor in surgery to have charge of surgical pathology. The following assistants were appointed to the medical dispensary: Dr. Geo. Lyman, Dr. W. H. Banks, Dr. W. R. P. Clark, Dr. Walter Schaller, Dr. P. H. Luttrell, and in the surgical dispensary Drs. W. W. Winterberg and I. W. Thorne. Provision has also been made for the appointment of an academic professor of obstetrics and gynecology.

Mr. D. B. Rosenkrants, recently of Upper Iowa University, has been appointed instructor in botany at the North Carolina College of Agriculture and Mechanic Arts.

THE Vienna correspondent of the *Journal* of the American Medical Association writes that at present there are two medical posts vacant in Austria: one at the clinic for internal medicine in Innsbruck, from which Ortner was called to Vienna to succeed von Strümpell, and the other at the pharmacologic institute of the German university in Prague. The latter has become vacant through Professor Pohl's acceptance of an appointment at Breslau. The following scientists have been recommended in the order named for the vacant post: for Innsbruck, Professor Pfeiffer from Graz, well known for his researches on serology, hematology and diseases of the lungs; Docent Dr. Schmidt (Vienna) and Professor von Tabora from Strasburg and also Professor Walks from Prague; for the pharmacologic institute, Professor Cloetta from Zurich, Professor Wiechowski, who is at present an assistant of Horst-Meyer in Vienna, and Professor Jodlbauer in Munich.

MR. HERBERT BOLTON, F.G.S., curator of the Bristol Museum of Natural History, has been appointed reader in paleontology in the University of Bristol.

DR. SAMUEL OPPENHEIM, of Prague, has been elected professor of astronomy in the University of Berlin.

DISCUSSION AND CORRESPONDENCE

CONCERNING THE "NEMATOCYSTS OF MICROSTOMA"

PROFESSOR GLASER in SCIENCE of July 14, 1911, has criticized my recent paper on "Nematocysts of Microstoma."[1] In the first place he indicates that I have made a quotation from his paper and given credit for it to Boulenger. This was a piece of carelessness on my part. That it was an inadvertence is shown in that the page numbers given refer to Glaser's article, to which I meant to give credit. I greatly regret that this blunder has been made and I am grateful to Professor Glaser for calling my attention to it.

My critic continues by saying, "Professor Kepner states that the cnidophages of æolids deliver their nematocysts to the cnidocyst, whereas the endodermal cells of *Microstoma* deliver their nematocysts to the mesoderm. Unfortunately for the analogy, both Grosvenor and I have shown that the cnidophages after engulfing a certain number of nettles, metamorphose directly into cnidocysts."[2] I had attempted to make no *analogy* in this case nor was I concerned with the manner in which the cnidocyst was formed. I had attempted to make a *comparison*. The cnidophages of æolids by metamorphosing to form the cnidocysts do not involve the mesodermal cells and thus may be *compared* with the endodermal cells of *Microstoma* which deliver the nematocysts to the mesoderm.

Professor Glaser in the third place criticizes me for quoting Grosvenor in support of the idea that the nematocysts of æolids are of defensive value, and at the same time overlooking the work of Cuenot and Glaser which showed that the "defensive value of the nettles is slight if not negligible." I had not overlooked this work of Cuenot and Glaser on the nematocysts of æolids. Despite this negative evidence I am constrained to believe that the nematocysts of *Microstoma* are of defensive value.

Finally my critic states that I have raised the question whether æolids have acquired their method of dealing with nematocysts of cœlenterates through flatworm ancestry. This question was suggested. Professor Glaser, however, is unfair to me in not stating that I had placed by the side of this the alternative question whether we had here cases of parallel development. Two questions, not one, were thus raised by me, and I feel quite unready to defend either hypothesis.

Giving credit to whom credit is due, the fact remains that the endodermal cells of *Microstoma* collect the nematocysts of *Hydra* to deliver them to mesodermal cells. Certain mesodermal cells transport these nematocysts to and orient them at the ectoderm.

This intricate process has no meaning un-

[1] *Biological Bulletin*, Vol. XX., No. 5.

[2] SCIENCE, Vol. XXXIV., July 14, 1911, pp. 51–2.

less the nematocysts have important defensive value to the flatworm.

Wm. A. Kepner

Biological Laboratory,
University of Virginia,
July 15, 1911

SCIENTIFIC BOOKS

Convergence in Evolution. By Arthur Willey. London, John Murray. Pp. 177, 12 figs. 1911.

In "Convergence in Evolution" Professor Willey has written an illuminating exposition of the wide-spread occurrence of convergence in animal structure and habit, and a strong argument for a fairer recognition of its validity and importance. Indeed, this argument is sometimes so strong, at least in its wording, that it seems almost to overshoot the mark. It makes convergence seem too important, too dominant, too universal, to be true. For example—perhaps a slightly unfair one, wrested thus from its context—Professor Willey says of histologic identity:

> In the light of facts which are now available it even begins to appear strange, although only a matter of a few years or months ago, that histological identity should ever have been insisted upon as a criterion of homology except within well-defined limits (p. 153).

But despite his enthusiasm for convergence and his avowed intent to unseat homology from its high place, Professor Willey never means to be unfair. He is simply a convinced believer, a positive expositor and a strong debater. He asks only for a recognition of the facts. He has no laws of convergence to offer any more than he will agree to accept any one universal criterion of homology.

> Then away with laws and away with criteria until they cease to obscure the facts as they are (p. 170).

The book is thoroughly interesting reading for a zoologist. It is a mine of illustrations of adaptive convergence. Indeed, it might be offered as a reference book of animal adaptations. Examples of extraordinary similarities in superficial and histologic structure in all parts of the bodies of animals of all the phyla crowd the pages of the book. For not a few of these the author is able to draw on his own contributions to the knowledge of animal morphology. For the others he usually gives satisfactory references.

I am tempted to take out of the book some of the choice examples. But I shall be doing my readers a greater favor if by refraining from doing this, and at the same time telling them how interesting and suggestive many of of these examples are, I can induce them to see the whole book. To read it as a whole is the more desirable also because of the unusually independent and original points of view from which the author examines many current biological theories and problems. Indeed the book is so refreshing and stimulating in its forthright outspokenness with regard to much that many of us feel insurgent about but hesitate to speak out about, that it is worth while for this alone. All the convergence in it will be surplus for your money!

Just one thing to act as "snapper" at the end of this otherwise unmitigated enthusiasm of commendation. The style in which the book is written is unfortunate. Not as to sentence construction, paragraphs, grammar, punctuation, but as to abruptness of attack and of leaving off; of pertinence of matter to subject, of illustration to point. One loses his bearings too often in the book. One wonders whether this example belongs to the subject behind it or to the one in front of it. Or indeed whether it belongs in the book at all. But readers of scientific books are, from long experience, immune to most of the difficulties which unusual manners of writing can present. They are accustomed to dig their gold wherever and however they find it concealed. And Professor Willey's book has much good gold in it for any digger.

V. L. K.

Stanford University, Cal.

A Monograph of the Naiades of Pennsylvania. By Arnold E. Ortmann, Ph.D. Memoirs of the Carnegie Museum, IV., No. 6, February, 1911, pp. 279–347; pl. 86–89; 4to.

This memoir—confined to a discussion of the anatomical characters, especially the structure of the gills, and to an arrangement of the different groups in conformity with the data newly obtained or now correlated by Dr. Ortmann—comprises an important advance in our knowledge of the fresh-water mussels. Giving full credit to Lea and Simpson, pioneers in the classification of these animals on the basis of the characteristics of the reproductive organs and marsupium, the author's studies of the microscopic structure of these organs have enabled him to rectify some errors and add very largely to the available data. The details are well illustrated both by text figures and excellent plates. The description and illustration of the Pennsylvanian species is reserved for future publication.

Dr. Ortmann, on account of certain archaic features, proposes for *Magaritana* a separate family, retaining the other Pennsylvanian forms in the Unionidæ which he divides into three subfamilies. He proposes a new genus *Paraptera* for *Lampsilis gracilis* (Barnes) on account of peculiarities of the glochidia. We note that he adopts for the group commonly known as *Glabaris* the name of *Anodontites* which was first applied by Bruguière. This name is undoubtedly prior to any other for the group in question, but by the rules in vogue, at the time it was proposed the termination *ites* was reserved for fossil species, and it was therefore not adopted. If *Anodontites* be rejected *Patularia* Swainson precedes *Glabaris* in date.

WM. H. DALL

The Sources and Modes of Infection. By CHARLES V. CHAPIN, M.D., Sc.D., Superintendent on Health, Providence, R. I., author of Municipal Sanitation in the United States. New York, John Wiley and Sons; London, Chapman and Hall, Limited. Octavo. Pp. ix + 399. 1910.

Any book written by this author is worthy of attention, and this one especially so—for in it is contained a summary of our knowledge of the subjects of which it treats and the interpretation put upon this knowledge by one possessed of wide experience. Some of the conclusions arrived at will be startling to those unfamiliar with the general trend of modern thought, but none are put forward that are not logically in sequence to the evidence presented. It will be difficult to secure general acceptance of such conclusions as this (p. 28): "While municipal improvements, such as the above" (cleaning of streets, back alleys, etc., regulation of offensive trades and prevention of nuisances generally), "are advisable, there is little more real reason why health officials should work for them, than there is that they should work for free transfers, cheaper commutation tickets—all good things in their way and tending towards comfort and health." Yet the author brings forward apparently good evidence to show that such statements are warranted. Perhaps the most valuable chapter is the second—in which stress is laid upon "carriers and missed cases" as most important sources of infection. Attention is called to the great influence of infection by contact—the comparative slight importance of infection by fomites or by air; instances are given of the favorable results following the abandonment of disinfection in certain of the infectious diseases in Providence, and a proper amount of stress is laid upon the transmission of certain diseases by insects. For all who are interested in these subjects the book will be a valuable aid in recognizing the present evidence upon which the control of infectious diseases must rest.

HAROLD C. ERNST
HARVARD MEDICAL SCHOOL

BOTANICAL NOTES

A READABLE BOOK

AMONG the most readable of recent botanical books is that on "The Evolution of Plants," by President D. H. Scott, of the Linnean Society of London (New York, Holt). In about two hundred and fifty duodecimo pages the author discusses the evolution of plants most entertainingly and lucidly, confining himself, however, to the flowering plants and the "higher spore plants."

The scope of the work may be appreciated from the chapter headings, which include a discussion of the Darwinian theory, the nature of the evidence, the fossil record. the problem and the evidence in regard to seed plants, evolution of ferns, club-mosses, horsetails and sphenophylls. There is a handy glossary for the non-botanical reader, and a brief bibliography.

We may close this brief notice by quoting a paragraph from the author's "conclusions" (p. 29):

> The first and most obvious result of our inquiries is to prove the enormous antiquity of highly-organized plants. If a botanist were set to examine, without prejudice, the structure of those Devonian plants which have come down to us in a fit state for such investigation, it would probably never occur to him that they were any simpler than plants of the present day; he would find them different in many ways, but about on the same general level of organization. Within the period from the Devonian age to our own time organization is not shown to have "largely advanced," though there have been many changes. It is not contended that there has been no advance; the special adaptations of the Flowering Plants to Insect life and in other ways show progress in many directions, corresponding to increased complexity in the conditions of life. It must be borne in mind, however, that we know very little as yet about such special adaptations among plants of earlier periods.

A NEW TEXT-BOOK OF BOTANY

Nine years ago Professor Dr. Henry Kraemer brought out the first edition of a book under the title of "A Text-book of Botany and Pharmacognosy" which the present reviewer was glad to commend as an effort to secure a better botanical foundation for students of pharmacy. Since then two editions have appeared (1907, 1908) and now we have a fourth edition (Lippincott, 1910) much enlarged and improved. The plan of the work remains practically the same as in the earlier editions. Part I. is devoted to botany and includes chapters on the principal groups of plants, the outer morphology of angiosperms, the inner morphology of the higher plants, classification of angiosperms yielding vegetable drugs, and cultivation of medicinal plants. In looking over this portion of the book, which covers more than 400 pages, the botanist is struck with the fact that at last the medical men of America have awakened to the fact that the botanical foundation for their students must be broad and solid. The treatment in this portion of the book is so entirely different from that which has too often been given to medical students that there is no similarity whatever. It is very good indeed and the author is to be congratulated upon his interpretation of the methods of the modern study of pharmacy.

Part II., covering about 300 pages, is devoted to pharmacognosy and includes two chapters, the first and longest being devoted to crude drugs and the second to powdered drugs and foods. The remaining parts, which include about 50 pages, are devoted to reagents and technique and micro-analysis.

The author has a keen sense of the need of the particular treatment which he has given the subject, as is shown by his statement that "while there are some teachers who naturally prefer their students to have an independent course in botany before taking up pharmacognosy, the treatment of this subject in this books is such as to be directly applicable to pharmaceutical work, and will be found useful to the student of pharmacy in the college course, as well as of assistance to the pharmacist and analyst who engages in practical pharmacognostical work." With this statement the present reviewer most heartily agrees. In fact, he has looked over these earlier chapters and has wondered whether the purely botanical portion would not be a most excellent text-book in botanical laboratories. Certainly in this day when we are trying to relate our sciences more and more to their applications, the treatment here is most suggestive and commendable.

Dr. Kraemer has introduced an interesting feature in his study of drugs in suggesting simple methods by which the crystalline extracts may be obtained by the student. This, no doubt, will add very greatly to the interest

of the study and is a feature to be greatly commended.

CHARLES E. BESSEY
UNIVERSITY OF NEBRASKA

SPECIAL ARTICLES

PROGRESSIVE VARIATION IN DECAPTERUS, A GENUS OF CARANGOID FISHES

IN the fishes of the genus *Decapterus* which the writer has examined here and abroad, six forms are recognizable, making a series from species which perhaps belong rather to *Caranx*, to the most extreme *Decapterus*. Typical *Decapterus* departs from the *Caranx* type in being less deep, less compressed, in having the last ray of the dorsal and anal fins separate from the rest of the fin, forming a mackerel-like finlet, and in possessing a bluntly pointed protuberance with a groove beside it, on the shoulder girdle under the edge of the gill cover, suggesting a not dissimilar structure in *Trachurops*, but less pronounced. The most *Caranx*-like of the six is *Decapterus affinis* of the Pacific and Indian Oceans. The four middle forms are intermediates between this and the least *Caranx*-like, *D. macarellus*. This progressive variation is readily explicable by a very attractive theory of variation with migration, submitted for what it is worth.

The six forms are:

1. *D. affinis* (Rüppel). Figured by Day ("Fauna British India, Fishes") and Jordan and Seale ("Fishes of Samoa," *D. lundini*). Specimens have been examined in the British Museum.

Depth 3.5 in length to fork of caudal. Anal soft rays 20–22. Lateral line with 50–53 scales followed by 42–47 scutes. Last ray of dorsal and anal not detached from the rest of the fin. Teeth small, evident.

Range—Pacific and Indian Oceans.

2. *D. rhonchus* (G. St.H.). A specimen examined in the Paris Museum.

Depth 4.0. Anal soft rays 25–27. 56 scales followed by 23–26 scutes in the lateral line. Last ray of dorsal and anal not detached. Teeth small, evident. Without the peculiar shoulder structure mentioned above.

Range—north and west coasts of Africa.

3. *D. maru-adsi* (Temminck & Schlegel). A specimen examined in the Paris Museum. Cat. Fish, Brit. Mus. II.

Depth 4.5. Anal rays 28. 50 scales followed by 36 scutes in lateral line. Last rays dorsal and anal detached from the remainder of the fin. Teeth minute, evident. With the peculiar shoulder structure.

Range—Japan and China coasts.

4. *D. kurra* (Cuv. & Val.). Day, Fauna British India, Fishes. The type of *D. kiliche*, C. & V., examined in the Paris Museum.

Depth 5.0. Anal rays 26. 47–55 scales followed by 33 scutes in lateral line. Last rays dorsal and anal detached. Teeth minute, evident. Peculiar shoulder structure present.

Range—Indian Ocean.

5. *D. punctatus* (Ag.). Specimens examined in the Paris Museum labelled *D. punctatus* and *D. kurroides*. Bull. 47, U. S. National Museum.

Depth 5.0. Anal rays 25. 56 scales followed by 32 scutes. Last dorsal and anal rays detached. Teeth minute, evident. Peculiar shoulder structure present.

Range—Atlantic Ocean.

6. *D. macarellus* (Cuv. & Val.). Types of *D. macarellus, pinnulatus, jacobæus* and *scombrinus*, examined in the Paris Museum. *D. macarellus* and *D. sanctæ-helenæ*, Bull. 47, U. S. National Museum.

Depth 5.5–6.0. Anal rays 28–31. 94–96 scales followed by 28–30 scutes. Last dorsal and anal rays detached. Teeth not evident. Peculiar shoulder structure present.

Range—Atlantic and Pacific Oceans.

Nos. 1 and 2 of this series would perhaps fit better in *Caranx* than in *Decapterus* (being more or less intermediate between *C. djedaba* and the genus *Decapterus*). Specimens of *rhonchus* and *maru-adsi* placed side by side resembled one another very much, the most noticeable differences being the imperfectly separated last dorsal and anal rays, and absence of shoulder peculiarity in *rhonchus*. *Punctatus* is much less compressed than *maru-adsi*, and *kurra* intermediate between these two as is its range. These three

are the most closely related forms. Between *punctatus* and *macarellus* is a sharp break.

An explanation of the distribution of the forms is that *affinis* spread from the Indian Ocean westward around the world. The form differentiated in the Atlantic was *rhonchus* and in the Pacific *maru-adsi,* species whose range has since been restricted to Africa and Japan and China, but still the westward migration continued, *maru-adsi* migrated into the Indian where it became *kurra,* separated by intermediate stages from the *affinis,* which had been there since the beginning and still pushing westward became *punctatus* in the Atlantic and *macarellus* in the Pacific.

With this theory as a view-point the thing that immediately calls for explanation is the relation to one another of the two final forms *punctatus* and *macarellus,* and of their ranges. The forms are so strongly differentiated as to presuppose long separation by a barrier as of land, yet they are the only adjoining members of the series occurring in the same waters, as they do in the Atlantic. A land connection from Africa to South America would obviate this difficulty as the two forms would at once have invaded one another's Atlantic ranges when this barrier was removed. Also we must explain the peculiar range of *macarellus,* found in Atlantic and Pacific, but not in the Indian, which may be readily done by supposing that the North and South American land connection is of recent origin.

J. T. Nichols
American Museum of Natural History

THE AMERICAN CHEMICAL SOCIETY

The Effect of the Club Root Disease upon the Ash Constituent of the Cabbage Root: Howard S. Reed.

The ash analysis of healthy and diseased cabbage roots reveals appreciable variations in the amounts of certain constituents while others vary but slightly. In the diseased roots there was an appreciable increase in the amounts of calcium, magnesium, phosphoric acid, potassium and sulphuric acid, *i. e.,* an increase in the amount of "essential" elements.

The greatest increase of any single constituent was in the case of potassium. The increase of potassium appears to be coupled with an increase of protoplasmic substance and accumulation of starch.

The proportion of calcium to magnesium is greater in the diseased roots. The same is also true of the proportion of potassium to sodium, but there is no material difference in the proportion of magnesium to phosphorus. The differences in the amounts and proportion of ash constituents appear sufficiently well marked to indicate a more or less definite correlation in the metabolism both of healthy and of diseased plants.

Effect of Frost on the Aromatic Constituents of the Peppermint Plant: Frank Rabak.

The Volatile Leaf-oil of the Washington Cedar, Thuja plicata: Robert E. Rose and Carl Livingstone.

Absorption and Excretion of Salts by Roots, as Influenced by Concentration and Composition of Culture Solutions: I., Concentration Relations of Dilute Solutions of Calcium and Magnesium Nitrates to Pea Roots: R. H. True and H. H. Bartlett.

Creatinine in Plants and in the Medium in which they Grow: M. X. Sullivan.

The Effect of Temperature on the Respiration of Fruits: H. C. Gore.

The Phosphorus Assimilation of Aspergillus niger: Arthur W. Dox.

(From the Chemical Section of the Iowa Agricultural Experiment Station.)

The necessity for some form of phosphorus in culture media for lower fungi has long been recognized. Notwithstanding the variety of phosphorus compounds occurring in nature, very few have been tested with regard to their availability as sources of this element for mold cultures. Among the substances tested in this experiment were phytin, sodium glycerinophosphate, sodium nucleinate, lecithin, casein, ovovitellin, ortho-, pyro- and metaphosphates, hypophosphites and phosphites. All but the last two, which contain trivalent phosphorus, were readily utilized.

Fermentation and Putrefaction: Arthur I. Kendall.

(From the Department of Preventive Medicine and Hygiene, Harvard Medical School.)

As shown by the work of the author and others, utilizable carbohydrates protect nitrogen from attack by bacteria. This finds its analogue in the metabolism of higher forms. Fermentation takes precedence over putrefaction. For the purposes of this paper, by fermentation is meant the

action of bacteria upon carbohydrates; while by putrefaction is meant the action of bacteria upon nitrogenous substances. The two phenomena, fermentation and putrefaction, are antagonistic processes: the obligate putrefactive bacteria can not, as a rule, grow in media in which active fermentation is going on, because the acids produced inhibit their development. There is a third group, the facultative organisms, which are able to adapt themselves to both kinds of food. This is an important new conception. Thus in the presence of dextrose the diphtheria bacillus elaborates no toxin, while in its absence large amounts are formed. *B. coli* behaves similarly. Not only do the products vary, but the composition of the bacteria themselves may be altered. All these considerations will prove of great importance in practise.

The Carbon Nitrogen Ratio in the Decay of Protein Compounds: JACOB G. LIPMAN.

Biochemical and Toxicological Studies upon Penicillium: C. L. ALSBERG and O. F. BLACK.

A Study of the Optical Forms of Lactic Acids produced by Pure Cultures of B. bulgaricus: JAMES N. CORRY.

Nucleic Acid in Soils: EDMUND C. SHOREY.

Conditions for Tannic Acid Fermentation: LEWIS KNUDSON.

As a result of the fermentation of tannic acid (gallotannic), gallic acid is formed. Van Tieghem first showed that the fermentation of this substance may be effected by the two organisms *Aspergillus niger* and *Penicillium glaucum*. Pottevin and Fernbach simultaneously reported the extraction of the enzyme tannase, the transforming agent. Since that time several other investigators have contributed to the subject.

Experiments made by the writer indicate that if tannic acid alone is offered as a source of carbon, the gallic acid formed as a result of the tannic acid transformation is utilized in the metabolism of the organism—the greater the growth of the fungus, the greater is the decrease in tannic acid. It is likewise shown that the duration of growth, the presence of other nutrients and aeration—factors influencing growth mass—were important considerations with respect to the yield of gallic acid.

An infusion of gall nuts contains, in addition to tannic acid and gallic acids, other organic compounds as well as inorganic salts. When cultures are made in which the gall nut infusion is used as the nutrient solution, the tannic acid is transformed; but the gallic acid is not at first utilized. The organism seems to elect the other organic compounds first and then some of the gallic is utilized. There is then an election of food by the organism.

If there is offered to *Aspergillus niger* or *Penicillium* sp. in a nutrient salt solution, 10 per cent. cane sugar along with 13 per cent. tannic acid, then the sugar entirely protects the gallic acid formed from assimilation, or use as food by the fungus. A 5 per cent. concentration of sugar is not sufficient to protect the gallic acid, during the growth interval employed.

Experiments were also made in which the fermentation cultures were kept under anaerobic, and also limited oxygen conditions, and the results obtained were compared with those in which growth was permitted under more favorable conditions of aeration and nutrition.

Regulatory Formation of the Enzyme Tannase: LEWIS KNUDSON.

The work of Fermi, Pfeffer, Katz, Went, Dox and others has shown that to a considerable extent the formation of enzymes is influenced markedly by the nutrition of the organism. According to Dox, the production of those enzymes that are not normally developed by the organism in demonstrable quantities can not be induced by any special nutrition. This statement is not in accord with the results obtained by Went; nor with the more recent work of Harden and Norris working with yeast, wherein it is shown that there may be induced by special nutrition an enzyme which normally did not occur in the yeast plant. The work of the writer, herewith briefly reported, is also in disagreement with the results of Dox.

The two organisms, *Aspergillus niger* and *Penicillium* sp., which normally develop on commercial gall nuts when these are moistened and exposed to the air, produce the enzyme tannase; and this enzyme is capable of effecting the transformation of tannic acid into gallic acid and glucose.

Pottevin found that the enzyme tannase was formed in *Aspergillus niger* when it was grown in Raulin's solution in which the sugar was replaced by tannic or gallic acid. The writer has grown the organism in synthetic solutions in which the carbon nutrient, cane sugar, was replaced entirely or supplemented by one of several carbon compounds. In the experiments the effect of each of fourteen different carbon compounds was tested, but the enzyme tannase was produced only when the sugar was replaced by tannic or gallic acid,

or supplemented by tannic acid. The gallic acid, furthermore, was not as efficient as the tannic acid in stimulating the formation of the enzyme.

Some work has been done showing that the quantity of a particular enzyme produced irrespective of the character of the carbon nutrient, can be increased in amount by offering the organism the carbon compound which is transformed by the enzyme in question. No work apparently has been reported on the effect of concentration of the transformable substance on the quantity of the corresponding enzyme produced. Employing the two organisms mentioned, the writer made experiments, in which a modified Czapek's solution was the nutrient medium—in this the concentration of sugar was made 10 per cent., and it was supplemented by tannic acid in concentrations varying from 0.01 per cent. to 10 per cent. The quantity of the enzyme produced was augmented by increase in concentration of the tannic acid. None, however, was formed when the concentration of tannic acid was as low as 0.01 per cent.

Similar results were obtained with *Penicillium* sp. *Aspergillus candidus, Aspergillus oryzæ* and *Penicillium granulatum* cultivated in a synthetic solution in which the carbon was supplied as 5 per cent. cane sugar and supplemented by 2 per cent. tannic acid also developed the enzyme tannase. *Penicillium expansum* in a similar solution did not develop the enzyme.

The enzyme tannase would fall then in the third class, as described by Went, which class includes only those enzymes which are produced when a particular carbon compound is present in the nutrient solution.

The Synthesis of Fats by the Action of Enzymes: F. L. Dunlap and L. O. Gilbert.

Five grams oil-free castor bean, 5 g. flaxseed, 25.5 g. glycerol, 16.7 g. Kahlbaum's oleic acid were triturated in a mortar till emulsified. The flaxseed was introduced to perfect the emulsion. It is without action. This emulsion was allowed to stand and its acidity titrated at intervals. After eleven days the loss of acidity was such as to correspond to a disappearance of over 26 per cent. of the total oleic acid present, so that the enzyme of ricinus has undoubted synthetic power.

On the Measurement of the Oxidase Content of Plant Juices: H. H. Bunzel.

The Pigmentation of the Adult Periodical Cicada, with a Note on Chemical Anti-oxidases: Ross Aiken Gortner, the Carnegie Institution of Washington.

The black pigment of the periodical cicada (*Tibicen septendecim* L.) is shown to be produced by the interaction of a chromogen and an oxidase of the tyrosinase group. Coloration proceeds after death but does not produce the normal uniform coloration, since, apparently, the tyrosinase is secreted together with the new cuticula, and after death this secretion ceases.

In the note on chemical anti-oxidases the suggestion is made that, perhaps, dominant whites are due to the presence of aromatic compounds carrying two hydroxyl groups in meta position to each other. It was noted that tyrosin did not produce the typical coloration in the presence of tyrosinase when orcin, resorcin or phloroglucin—all meta-di-hydroxyl benzol derivatives—were present in the solution. This result was, apparently, caused by the tyrosinase being affected in the same manner as though an anti-oxidase were present, for proof was given that the tyrosin had not united chemically with the m-di-hydroxyl compound, and data were also given which makes it appear very improbable that the cause lies in a more rapid oxidation of the orcin, etc., to colorless derivatives. The only other alternative is that the action is of the same nature as that of a true anti-oxidase. If, therefore, through some body process, an additional hydroxyl were added to tyrosin adjacent to the alkyl chain, a compound would result which should not give colors with tyrosinase, nor allow colors to be produced even though tyrosin were present. Such a situation would produce dominant whites.

A Study of the Methan Fermentation in the First Stomach of Ruminants: Sleeter Bull.

Crude fiber, or cellulose and starch, undergo a fermentation in the paunch of ruminants with the formation of methane carbon dioxide, acetic acid, butyric acid and isobutyric acid.

By the artificial fermentation of cellulose it was found that 1.0 gm. of cellulose produced .033–.040 gm. of methane.

Omeliansky found that one gram of cellulose produced .068 gm. of methane, .3057 gm. of acetic acid and .2038 gm. of butyric and isobutyric acid.

Knowing the energy value of the cellulose—4.220 cals.—and that of the products of the fermentation, it may be computed that 1.4048 cals. of energy are liberated as "heat of fermentation" in the fermentation of one gram of cellulose. Expressed in terms of methane, 1.1549 cals. of energy are lost as "heat of fermentation," for every calory of methane excreted by the animal.

Applying this factor to results of experiments upon steers with the respiration calorimeter at the Institute of Animal Nutrition of the Pennsylvania State College, in which the amount of methane excreted and the amount of heat emitted after the ingestion of a known amount of food were determined, it is found that in the case of a hay ration 32 per cent. of the "heat of digestion" arose from the methane fermentation of the carbohydrates.

Effects of the Quantity of Protein Ingested on the Nutrition of Animals: II., On the Weight of some of the Vital Organs of Lambs: W. D. CARROLL and A. D. EMMETT.

Effects of the Quantity of Protein Ingested on the Nutrition of Animals: III., On the Ash and Total Phosphorus of Flesh from Lambs: R. H. WILLIAMS and A. D. EMMETT.

Effects of the Quantity of Protein Ingested on the Nutrition of Animals: IV., On the Creatin of Flesh from Swine and Lambs: W. E. JOSEPH and A. D. EMMETT.

A Cage Designed for Metabolism Experiments on Goats: A. R. ROSE.

In this station it was found most practical, when using the cow, in metabolism experiments, to keep men constantly on the watch to collect the excreta. This method is exceedingly laborious, and a smaller animal which could be caged easily was sought as a substitute for the unwieldy cow. For this purpose the goat serves admirably, and it is rather remarkable that an animal with so many qualifications for metabolism work has received so little attention. The goat is of convenient size to be readily handled, and it takes rations and yields excreta of very satisfactory bulk and might very well represent the herbivora in animal experimentation. It becomes quickly at home in the cage and adjusted to the demands of the investigator.

The cage consists essentially of an elevated wooden box, with gratings in the upper part, to admit light and air. Inside wooden walls are covered by galvanized sheet iron. One side is attached only at the top by means of hinges, and forms a door to admit or remove the goat, and for convenience in milking.

The floor is a heavy wire screen with wires sufficiently far apart to let all waste pass through, yet allowing five wires for each foot to rest upon.

Under the screen, at the front end, is a pan to collect any food dropped in eating. Under the rest of the floor is the device for separating the excreta from one another, consisting of two galvanized sheet iron parts, the hopper and urine pan. This hopper terminates in a trough leading toward the front end of the cage. This trough has at the point of junction with the hopper, an opening in its bottom protected by strands of wire, by which the dung pellets coming down the hopper are deflected into a suitable removable receptacle standing on the floor under the front end of the cage. The urine passes through this hole into a shallow pan suspended from the hopper trough, immediately beneath. This pan has an elongated spout leading forward through which the urine flows into another receptacle standing on the floor beside the one provided for the dung.

The cage is simple in construction. It was made by local carpenters with the aid of a tinsmith, at a cost of thirty-seven dollars. The complete cage occupies a floor space of about two by four feet, is seven feet high and can be easily carried by two men. The cage is equally applicable to studies on sheep.

On the Lipins of the Heart Muscle of the Ox: JACOB ROSENBLOOM.

(From the Laboratory of Biological Chemistry of Columbia University, at the College of Physicians and Surgeons, New York.)

MacLean[1] has found that the essential fat of the liver has the properties of phospholipin. He thinks it probable that the fatty matter from certain other organs is of the same nature. He finds by extraction of the liver with ether and alcohol, at room temperature, that 84 per cent. of the total extract is phospholipin in quality, whereas, if the extraction is carried out at the temperature of the *boiling* solvent, only about 40 per cent. of the extract partakes of the properties of phospholipin. MacLean believes that such treatment with the *boiling* solvent causes a cleavage of the tissue phospholipin, with a consequent increase in the amount of neutral fat in the extract.

In a study of the lipins of the heart muscle of the ox, practically identical percentages of neutral fat and phospholipin were found by the writer in the ether and alcohol extracts which had been obtained by treatment with the respective solvents at room temperature and also at their *boiling* temperatures. It is possible, however, that the ether and alcohol extracts of the liver contain substances of a lipin nature which are more easily

[1] MacLean, *Biochemical Journal*, 1909, IV., p. 455.

decomposed than those in similar extracts of heart muscle.

The Effect of Pregnancy on the Lipins of the Ovary and Corpus Luteum of the Cow: Jacob Rosenbloom.

(From the Laboratory of Biological Chemistry of Columbia University, at the College of Physicians and Surgeons, New York.)

A comparative study of the amounts of neutral fat, fatty acid, lecithan and cholesterol, in ether and alcohol extracts of the ovary and corpus luteum of the cow, showed that pregnancy had no effect on the respective proportions in which these substances appeared in the extracts.

Relation of Permeability to the Fertilization of the Ovum: E. P. Lyon and Shackell.

Demethylization under Normal and Pathological Conditions: I., Chronic Alcoholism: Wm. Salant and I. K. Phelps.

Elimination of Caffein in the Urine: Wm. Salant and J. B. Rieger.

The Effect of Diet on Resistance to Drugs: Wm. Salant.

The Stability of the Photogenic Material of the Lampyridæ and its Probable Chemical Nature: F. Alex McDermott.

The photogenic compound present in the Lampyridæ is much more stable towards atmospheric oxygen than has usually been thought, especially when dried out of contact with air; it presents many points of similarity to other known biologic products; from embryologic and chemical considerations it appears probable that it is a lipoid or lecithin.

Gases of Swiss Cheese: William M. Clark.

The Brine Soluble Compound found in Cheese: L. L. Van Slyke and Alfred W. Bosworth.

(Chemical Laboratory, New York Agricultural Experiment Station, Geneva, N. Y.)

Investigations which have been conducted in this laboratory during the past years have shown that during the ripening of cheddar cheese a form of protein is always produced which is soluble in a 5 per cent. sodium chloride solution. The presence of this brine-soluble compound was shown to be connected in some way with the development of acid in the cheese. The compound was at first erroneously supposed to be paracasein-monolactate and later free paracasein. In recent work it was noticed that calcium was always to be found associated with this brine-soluble compound when it was separated from the other cheese constituents by extraction with solution of c.p. sodium chloride (free from calcium), after first removing the water-soluble constituents.

This brine-soluble compound is always present in cheddar cheese. In a cheese two years old 40 per cent. of the nitrogen was present in this form. It is also a fact that in cheddar cheese all of the calcium is never extracted with water, part of it always being found in the brine extract. In camembert cheese, however, the reverse is found. After the first few hours this cheese contains no brine-soluble compound and all the calcium is found in the water extract. The brine-soluble compound is formed in this cheese, but, owing to the method of making, more acid is allowed to develop than in cheddar cheese and, as a consequence, the brine-soluble compound loses its calcium and thereby becomes free paracasein, which is insoluble in brine solution.

We believe that, according to the evidence in hand, the following equation represents the reaction which takes place where the compound in question is taken into solution by a salt solution:

$$\text{Calcium caseinate} + 2\ \text{NaCl} \rightleftarrows \text{Sodium caseinate} + \text{CaCl}_2.$$

We believe that the mass action, thus represented, is also connected with the precipitation produced upon adding calcium chloride to the brine-soluble compound after its solution has been freed from excess of chlorides by dialysis.

The Influence of Sodium Chloride on the Precipitability of Casein by Acetic Acid, and its bearing on the Partition of Nitrogen in Butter: Wm. N. Berg.

The Estimation of Creatin: Stanley R. Benedict.

Twenty c.c. of urine (or a volume equal to twice the amount which will be required for an accurate creatinine reading) is treated with 20 c.c. of approximately normal hydrochloric acid and the mixture boiled nearly to dryness in a beaker or open flask. After the mixture has almost reached dryness it is placed in a boiling water-bath, and allowed to remain there for about five minutes after the residue is approximately dry. With the aid of warm water the residue is then washed into a fifty c.c. volumetric flask, the mixture cooled and five c.c. of 8–10 per cent. basic lead acetate solution added, and the mixture diluted to exactly fifty c.c., and mixed by shaking. The mixture is filtered through a dry filter into a dry beaker and twenty-five c.c. of the filtrate used for the colorimetric determination as in Folin's process, save that six c.c. 10 per cent. alkali are

employed, which should best contain also five per cent. of rochelle salt. This process has the great advantage that in the conversion of the creatin less pigment is produced than in former methods.

The Determination of Calcium in the Presence of Phosphates and Magnesium: F. H. MCCRUDDEN.

Methods of Estimating Moisture in Tissues: WALDEMAR KOCH.

With valuable biological material it is sometimes desirable to make water estimations and the estimations of the other constituents on the same sample. As there is danger of decomposing the constituents by the high temperature employed for drying in the official method, comparisons of this method with the one devised some years ago[2] and used in this laboratory were made and are recorded in the following table:

	W. 8 Direct with Alcohol	W. 21 Dried by Heat at 95° C.
Proteins	48.5	47.5
Phosphatids	21.6	16.3
Cerebrosides	8.8	9.4[3]
Sulphatids	3.6	4.3[3]
Undetermined lipoids	8.2	11.0[4]
Organic and inorganic extractives	9.3	11.6
	100.0	100.1
Lip P in per cent. of total	62.5	53.6

The Preparation of Tissue for Toxicological Examination: JAMES P. ATKINSON.

The finely minced tissue is digested with artificial gastric juice. The solution is filtered and extracted for alkaloids in the usual way. After this extraction the material is evaporated with nitric acid and then examined for metallic poisons. This method has three advantages: (1) The examination may be completed within three days, (2) less personal attention is required, (3) the tissue is completely broken down and therefore allows a better extraction of the alkaloids than by extracting the minced tissue with acid alcohol.

Studies of Water Absorption by Colloids: WILLIAM J. GIES.

On the Diffusibility of Biological Substances through Rubber: WILLIAM J. GIES.

[2] W. Koch, *The Journal of the American Chemical Society*, Vol. XXXI., p. 1335.

[3] Variation due to difference of age.

[4] Increase due to fatty acids from destruction of phosphatids.

The Aging of Flour and its Effect on Digestion: J. A. WESENER and GEO. L. TELLER.

The Occurrence of Lipase in the Fat of the Common Fowl (Gallus domesticus): M. E. PENNINGTON and J. S. HEPBURN.

If a chicken be kept hard frozen or at the temperature of the room, or at any temperature between these two extremes, the acidity of the fat increases, as has been shown in previous publications of this laboratory. Since the fat-splitting enzyme, lipase, is found in many plant and animal tissues, this investigation was undertaken to determine if lipase be present in the crude fat of chickens. The technique is fairly simple. The crude abdominal fat is passed several times through a meat chopper; and its acidity is determined. A weighed sample of the ground fat is triturated in a mortar with sand, and then extracted with ten times its weight of water. Fifty c.c. of the aqueous extract and 1 c.c. of an ester (ethyl acetate, butyrate or benzoate, or amyl salicylate) are mixed, the solution is made neutral to phenolphthalein and incubated at 40° C. for periods of time varying between 24 and 168 hours—usually 72 hours. Toluol is used as a bactericide. Fifty c.c. samples of the aqueous extract are boiled, then run as blank experiments in exactly the same manner as were the determinations proper. At the end of the incubation both determinations and blank experiments are titrated; the increase in acidity of the determination proper over the blank is due to the action of lipase.

This research has demonstrated the presence of lipase in the crude abdominal fat of fresh chickens retaining the animal heat, and of chickens kept at temperatures from that of the room to that of the "freezer" for varying periods of time. The highest acidity of the crude fat, and the greatest activity of the lipase, occurred in chickens which had been kept hard frozen for sixteen months, or which had been permitted to putrefy at room temperature. The lowest acidity of the crude fat and the least activity of the lipase were found in a fresh chicken still retaining the animal heat. Apparently in fresh birds the enzyme is present as a zymogen, which is converted into the active form as the chicken ages after death.

Deterioration in Eggs as shown by Changes in the Moisture Content: A. D. GREENLEE.

Eggs contain a high percentage of moisture when fresh—white about 88 per cent. and yolk about 48 per cent. This percentage of moisture is constantly changing, due both to a loss to the

external atmosphere by evaporation and also to internal rearrangement. The yolk absorbs water from the white. This change increases with the temperature and time, and when carefully measured it becomes a good index of the condition and probable age of the egg. By test experiments on a uniform lot of eggs, held at a constant temperature and analyzed at short intervals of time, the rate of change of moisture content can be determined and plotted and by means of the subsequent formula derived, the condition of any lot of eggs can be predicted from the first analysis for any given date within the holding period.

By a further extension of the work now in progress it is hoped that the age and past history of the egg can be deciphered from a determination of the percentage and relative distribution of the moisture.

The Oxidation of Chicken Fat with Hydrogen Peroxide: J. S. HEPBURN.

When light, air, heat and enzymes act on fats and oils, the various constants undergo changes; and an increase in saponification number is usually accompanied by a decrease in Hehner number, and *vice versa*. This phenomenon is due chiefly to the oxidation of the unsaturated acids at the double bonds. However, when chickens are kept hard frozen, both the saponification number and the Hehner number experience simultaneous change in the same direction. Thus nine analyses give a mean saponification number 172.9 and a mean Hehner number 81.27 for fresh roasters, while three analyses of undrawn roasters, kept hard frozen for 16 months, give a mean saponification number 194.9 and a mean Hehner number 91.67; the two constants have increased at the same time. This species of fat decomposition must be due to oxidation of the carbon chain at or near the terminal carbon atoms. The recent work of Dakin upon the oxidation of saturated fatty acids by means of hydrogen peroxide, led to the present research.

Fat was extracted from chickens and analyzed. The extracted fat was heated on the water-bath for seven hours with three per cent. solution of hydrogen peroxide—six molecules of peroxide were used for each molecule of fat; the fat was then separated from the aqueous layer, washed free from peroxide with boiling water, filtered through paper and analyzed. The acidity always became higher; the iodine number usually decreased, though it occasionally increased. The saponification number and the Hehner number almost invariably increased simultaneously, hence dilute hydrogen peroxide at the temperature of the water-bath produces in chicken fat the same change as occurs in that fat *in situ* while hard frozen.

When oleic acid and stearic acid were oxidized in this manner, their saponification number decreased. This change is similar to that undergone by the fat of chickens kept hard frozen for periods of four months, at the end of which time both the saponification number and the Hehner number are lower than in the fat of fresh birds.

Detection and Rôle played by Polyatomic Phenols occurring in Apples as Glucosides: H. P. BASSETT.

In apples there is a glucoside resembling phloridzin. There is present also an enzyme which hydrolyzes it, liberating a polyatomic phenole. From the phenole by the action of an oxidizing enzyme a phlobaphene is formed. This oxidase reaction renders the fluid germicidal. It is suggested that this has a protective value for the fruit.

Observations on the Deterioration of Maize and Improvements in the Methods of Detecting it: O. F. BLACK and C. L. ALSBERG.

An Incubator for Moderate Temperatures: A. M. BUSWELL and RALPH H. MCKEE.

The incubator uses, without the aid of a relay, a 110-volt alternating current for the heating and the regulation of the current. The expanding liquid of the regulator is alcohol, the capillary U-tube outlet being filled with mercury. Five wires are sealed into the capillary tube and the resistances attached so that the voltage drop, as the mercury passes a sealed-in wire, will be but twenty volts. This is below the arcing voltage and consequently no carbonization occurs and practically no gas is formed by the make and break. The lights used for heating are in series with the mercury and such resistances as are pushed in by the expanding alcohol. Without attention the incubator kept between 36.5° and 37.5° for two months.

The Absorption of Inorganic Salts by Living Protoplasm: W. J. V. OSTERHOUT.

Carbohydrate Esters of the Higher Fatty Acids: WALTER R. BLOOR.

Esters of mannitol with stearic acid were prepared and their properties described. One of them was fed to animals. It was found that about 50 per cent. was absorbed.

(*To be continued*)